AEC AUTHORIZING LEGISLATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON LEGISLATION

OF THE

JOINT COMMITTEE ON ATOMIC ENERGY

CONGRESS OF THE UNITED STATES

EIGHTY-FIFTH CONGRESS

SECOND SESSION

ON

AEC AUTHORIZING LEGISLATION

MAY 14, 19, 27, JUNE 4, 9, 10, AND 11, 1958

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AEC AUTHORIZING LEGISLATION

WEDNESDAY, MAY 14, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to notice, at 10 a. m., in room 457, Senate Office Building, Hon. Chet Holifield (chairman of the subcommittee) presiding.

Present: Representatives Holifield, Durham (chairman of the Joint Committee), Price, Hosmer, and Van Zandt, and Senator Hickenlooper.

Also present: James T. Ramey, executive director; John T. Conway, assistant director; David R. Toll, staff counsel; George E. Brown, Jr., staff member, Joint Committee on Atomic Energy, and Bernard V. Dvoskin, GAO consultant.

Representative HOLIFIELD. The committee will be in order.

The Subcommittee on Legislation of the Joint Committee on Atomic Energy is meeting this morning to commence public hearings on AEC authorizing legislation matters.

It had been our intent to commence these hearings in March, prior to the Easter recess, but it became apparent that AEC would not be ready. The hearings were scheduled to commence April 16, 1958, but at the request of the AEC they were further deferred until the present date. These delays will make our problems harder, but at least the hearings are underway. Without objection, I would like to insert in the record at this point copies of the correspondence between the Joint Committee and the Commission pertaining to the scheduling of the hearings.

(The information referred to follows:)

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C., March 26, 1958.

Mr. LEWIS L. STRAUSS,
Chairman, United States Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: The Subcommittee on Legislation hopes to commence hearings on about April 16, 1958, on the proposed bill for authorization of appropriations to the Atomic Energy Commission for the fiscal year 1959.

It is requested that the Commission forward to the Joint Committee as much as possible of the proposed bill and explanatory materials on or before April 10, 1958.

Sincerely yours,

CHET HOLIFIELD,
Chairman, Subcommittee on Legislation.

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
April 22, 1958.

Hon. LEWIS L. STRAUSS,
Chairman, United States Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: This will confirm Mr. Ramey's phone call of this morning on my behalf suggesting that it would be desirable for the Commissioners to meet informally with the senior members of the Joint Committee to discuss ways and means of expediting consideration of the AEC authorization bill and particularly our informal discussions concerning the atomic power program.

It is imperative that the Commission understand the deep concern the Joint Committee feels concerning the delay in the authorization hearings and its possible effect on obtaining a well-balanced atomic power program. As you know, we had requested the AEC's submission as approved by the Bureau of the Budget on the authorization hearings be received by April 10 and hearings were scheduled to begin on April 16.

It is understood from Mr. Hollingsworth's phone call to Mr. Ramey that the Commission believes that it is fully cognizant of the need to expedite the AEC authorization bill but that it still has outstanding questions with the Bureau of the Budget. Mr. Hollingsworth also indicated that the Commissioners believe that further discussions with the Joint Committee would not expedite matters to any degree.

In view of the above situation we will not insist on further discussions between the Commissioners and the Joint Committee. However, it is my understanding that there are outstanding matters in the staff discussions, particularly the development of a 5-year program statement, which require further consideration. I believe it would be desirable to expedite these discussions in any event.

Sincerely yours,

CARL T. DURHAM, *Chairman.*

ATOMIC ENERGY COMMISSION,
Washington, D. C., May 2, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: Reference is made to your letter of April 22, 1958, confirming Mr. Ramey's phone call suggesting that it would be desirable for the Commissioners to meet informally with the senior members of the Joint Committee to discuss ways and means of expediting consideration of the AEC authorization bill and particularly our informal discussions concerning the atomic power program. Your letter also referred to the fact that it is imperative that the Commission understand the deep concern of the Joint Committee concerning the delay in authorization hearings and its possible effect on obtaining a well-balanced atomic power program. I am sure that you will agree that the Commission is as deeply concerned over the unavoidable delay in submitting its authorization bill as is your committee. I believe that my colleagues, Messrs. Vance and Graham, contacted you shortly after receipt of your letter and explained in some detail to you the situation concerning our negotiations with the Bureau of the Budget in connection with the authorization bill.

As to your suggestion that there be continued staff discussions concerning the development of a 5-year program statement I believe that Commissioners Graham and Vance met with you recently for the purpose of explaining to you the program as it is now being developed within the Commission.

Please be assured that we are doing everything possible to expedite the completion of our negotiations with the Bureau of the Budget so that we may present our authorization legislation to you as soon as possible.

Sincerely yours,

LEWIS L. STRAUSS, *Chairman.*

JOINT COMMITTEE ON ATOMIC ENERGY,
CONGRESS OF THE UNITED STATES,
May 2, 1958.

Mr. K. E. FIELDS,
General Manager, Atomic Energy Commission,
Washington, D. C.

DEAR MR. FIELDS: In connection with the forthcoming hearings by the Subcommittee on Legislation on proposed bills to authorize appropriations to the AEC for plant construction and acquisition, and for the cooperative power reactor demonstration program, it is requested that the Commission supply the following information:

(1) A list of all active projects, showing for each the amount authorized (or the cost estimate shown in the budgets submitted to Congress prior to the enactment of the Atomic Energy Act of 1954), the current cost estimate, the date of the current estimate, and the overrun or underrun.

(2) A list of active projects in which revised cost estimates have exceeded the authorization limitations after the project has been started, showing for each the amount authorized or appropriated, date of start of the project, cost estimate at time of start, date of revised estimate, amount of revised estimate, and overrun.

(3) A list of all completed projects authorized in fiscal years 1956 through 1958, showing for each the amount authorized, date of start of project, estimate at start of project, final cost, and overrun or underrun. Also, a list of projects connected in the current fiscal year which were undertaken under authority available to AEC prior to enactment of the Atomic Energy Act of 1954, showing for each project the estimated cost shown in the budget to the Congress, final cost, and the change.

(4) A summary of remaining unliquidated obligations, if any, for projects for which authorization was rescinded by section 108 of Public Law 85–162.

(5) A list of presently authorized projects which have been abandoned, revised, or substituted.

(6) A list of presently authorized projects which have not been started, with appropriate comments, including information as to holdbacks by the Bureau of the Budget.

(7) An analysis of unexpended balances for the operating and construction appropriations projected to June 30, 1958.

(8) A comparison of the original fiscal year 1959 authorization bill proposed to the Bureau of the Budget with that proposed to the Congress.

As you know, similar information was furnished the subcommittee last year. It would be helpful if we could have this information by May 9, 1958.

Sincerely yours,

CHET HOLIFIELD,
Chairman, Subcommittee on Legislation.

(The following data was received from AEC in reply to above letter:)

DATA PREPARED IN REPLY TO QUESTIONS RAISED BY HON. CHET HOLIFIELD, CHAIRMAN OF THE SUBCOMMITTEE ON LEGISLATION, JOINT COMMITTEE ON ATOMIC ENERGY, IN HIS LETTER OF MAY 2, 1958, TO K. E. FIELDS, GENERAL MANAGER, UNITED STATES ATOMIC ENERGY COMMISSION, MAY 9, 1958

TABLE 1-A.—*Estimated costs shown in authorizations enacted pursuant to sec. 261 of the Atomic Energy Act of 1954*

Project No.	Title	Amount authorized	Current estimated cost (May 5, 1958)	Underrun or (overrun)
	PUBLIC LAW 85-162			
58-b-1 [1]	Fabrication plant	$5,000,000	0	
58-b-2	Mechanical production line, Hanford, Wash.	1,500,000	$1,500,000	0
58-b-3 [1]	Metal treatment plant, Fernald, Ohio	850,000	0	
58-b-4	Improvements to production and supporting installations, Hanford, Wash., and Savannah River, S. C.	10,000,000	10,000,000	0
58-b-5	Additions to scrap plants, various sites	1,500,000	500,000	$1,000,000
58-b-6	Additions to gaseous diffusion plants	6,600,000	6,600,000	0
58-b-7	Reduction in fire hazards-gaseous diffusion plants, Oak Ridge, Paducah, and Portsmouth.	12,000,000	14,600,000	(2,600,000)
58-b-8	Production reactor for special nuclear materials; development, design, and engineering only.	3,000,000	3,000,000	0
58-c-1	Weapons production and development plant	10,000,000	10,000,000	0
58-c-2	Weapons special component plant	6,000,000	6,000,000	0
58-d-1	Manufacturing plant expansion Albuquerque, N. Mex.	3,325,000	3,325,000	0
58-d-2	Storage site modifications	2,000,000	2,000,000	0
58-d-3	High explosive development plant, Livermore, Calif.	2,100,000	2,100,000	0
58-d-4	Engineering and laboratory building, Los Alamos, N. Mex.	1,013,000	1,006,000	7,000
58-d-5	Ventilation system replacements, Los Alamos, N. Mex.	618,000	600,000	18,000
58-d-6	Reclamation foundry, shop, and warehouse, Sandia base, New Mexico.	308,000	308,000	0
58-d-7	Reactor, area III, Sandia base, New Mexico	2,900,000	3,185,000	(285,000)
58-d-8	Base construction, Nevada test site	350,000	350,000	0
58-d-9	Base construction, Eniwetok Proving Ground.	7,917,000	7,917,000	0
58-e-1	Power reactor development acceleration project.	11,500,000	10,506,000	994,000
58-e-3	Fuels technology center, Argonne National Laboratory, Illinois.	10,000,000	12,000,000	(2,000,000)
58-e-4	Modifications and additions, aircraft nuclear propulsion ground test plant, area No. 1, National Reactor Testing Station, Idaho.	8,000,000	8,000,000	0
58-e-5	Test installations for classified project	9,000,000	9,000,000	0
58-e-6 [2]	Project Sherwood plant	7,750,000	10,000,000	
58-e-7	Waste calcination system, National Reactor Testing Station, Idaho.	4,000,000	4,000,000	0
58-e-8	Hot cells	3,500,000	2,450,000	1,050,000
58-e-9	High temperature test installation, Bettis plant, Pennsylvania.	3,000,000	3,000,000	0
58-e-10	Destroyer reactor development plant	750,000	750,000	0
58-e-11	Sodium reactor experiment (SRE) modification, Santa Susana, Calif.	4,700,000	4,700,000	0
58-e-12	Liquid metal fuel reactor experiment (LMFRE).	17,500,000	17,500,000	0
58-e-13	Argonne boiling reactor (Arbor), National Reactor Testing Station, Idaho.	8,500,000	500,000	8,000,000
58-e-14	Natural uranium, graphite-moderated, gas-cooled, power reactor prototype; development, design, and engineering only.	3,000,000	3,000,000	0
58-e-15	Plutonium recycle experimental reactor designed for the production of 15,000-electrical-kilowatt equivalent.	15,000,000	15,000,000	0
58-f-1	Waste storage tanks, National Reactor Testing Station, Idaho.	3,700,000	2,900,000	800,000
58-f-2	Hot pilot plant	2,000,000	2,000,000	0
58-f-3	Land acquisition, National Reactor Testing Station, Idaho.	1,000,000	1,000,000	0
58-g-1	Accelerator improvements, University of California Radiation Laboratory, California.	875,000	875,000	0
58-h-1	Reactor improvements, Argonne National Laboratory, Illinois.	380,000	380,000	0

See footnotes at end of table.

TABLE 1–A.—*Estimated costs shown in authorizations enacted pursuant to sec. 261 of the Atomic Energy Act of 1954*—Continued

Project No.	Title	Amount authorized	Current estimated cost (May 5, 1958)	Underrun or (overrun)
	PUBLIC LAW 85–162—continued			
58-i-1	Mammalian radiation injury and recovery area, Oak Ridge National Laboratory, Tennessee.	$475,000	$475,000	0
58-j-1	Nuclear training project, Regional Nuclear Training Center, Puerto Rico.	2,500,000	3,000,000	($500,000)
58-k-1	Schools, Los Alamos, N. Mex.	965,000	965,000	0
58-k-2	Housing modifications, Los Alamos, N. Mex.	1,000,000	1,000,000	0
58-k-3	Additional water well, Los Alamos, N. Mex.	138,000	138,000	0
58-l	General plant projects	26,016,000	25,260,000	756,000
58-111 [2]	Cooperative power reactor demonstration program.	44,275,000	47,998,000	
58-104-1	Rehabilitation of steam plant, Oak Ridge		1,900,000	
	PUBLIC LAW 506, 84TH CONG., 2D SESS.			
57-a-2	Improvements to reactor instrumentation, Hanford, Wash.	8,000,000	1,295,000	6,705,000
57-a-3	Improved high level waste handling system, Savannah River.	5,000,000	5,000,000	0
57-a-4	Reactor facility safety improvements, Hanford.	5,000,000	4,990,000	10,000
57-a-5	Additional waste disposal system, Hanford	5,000,000	4,990,000	10,000
57-a-6	Charging and discharging system, Hanford	3,450,000	3,450,000	0
57-a-7	Modifications to existing production facilities for increased efficiency and safety, Hanford.	3,000,000	3,450,000	(450,000)
57-a-13	Renovation of service plant, Oak Ridge, Tenn.	450,000	267,000	183,000
57-b-1	Area 5 expansion	20,900,000	20,900,000	0
57-b-2	Weapons assembly plants	15,000,000	13,388,000	1,612,000
57-b-3	Weapons production and development plant	15,000,000	18,076,000	(3,076,000)
57-b-4	Weapons development and engineering facilities, Livermore.	10,000,000	11,964,000	(1,964,000)
57-b-5	Storage site modifications	2,000,000	2,119,000	(119,000)
57-c-1	Aircraft nuclear propulsion ground test plant, area No. 2, Idaho.	55,000,000	878,000	54,122,000
57-c-2	Research and developmental test plant	25,000,000	27,500,000	(2,500,000)
57-c-3	Modifications and expansion of aircraft nuclear propulsion ground test facilities, area No. 1, Idaho.	15,000,000	15,000,000	0
57-c-4	Small submarine reactor test facility	10,000,000	13,500,000	(3,500,000)
57-c-5	Expended core handling and service plant, National Reactor Testing Station.	4,750,000	4,750,000	0
57-c-6 [1]	Food irradiation facility	3,000,000	0	3,000,000
57-c-7	Project Sherwood plant	2,000,000	1,025,000	975,000
57-c-8	Argonne low power reactor facility	1,225,000	1,904,000	(679,000)
57-c-9	Materials testing reactor hot cell extension, National Reactor Testing Station.	310,000	310,000	0
57-d-1	High-energy accelerator	27,000,000	27,000,000	0
57-d-2	Bevatron research plant, University of California Radiation Laboratory.	1,084,000	1,084,000	0
57-d-3	48-inch heavy particle cyclotron, Oak Ridge National Laboratory.	459,000	533,000	(74,000)
57-d-4	Conversion of accelerator design building, University of California Radiation Laboratory.	300,000	300,000	0
57-e-1	Analytical laboratory addition, Grand Junction.	362,000	339,000	23,000
57-f-1	Metallurgy laboratory, Livermore, Calif.	2,270,000	2,270,000	0
57-f-2	Base construction, Pacific Proving Ground	1,569,000	1,675,000	(106,000)
57-f-3	High-explosive and weaponizing plant, Livermore.	1,100,000	1,125,000	(25,000)
57-f-4	Installation of 115-kilovolt tie line, Los Alamos, N. Nex.	1,000,000	830,000	170,000
57-f-5	Base construction, Nevada test site	543,000	597,000	(54,000)
57-f-7	Warehouse, Sandia	308,000	258,000	50,000
57-f-9	Programing building, Livermore, Calif.	180,000	180,000	0
57-g-1	Addition to electrical power system, National Reactor Testing Station.	3,800,000	3,800,000	0
57-g-2	Chemistry cave for radioactive materials, Argonne National Laboratory.	800,000	778,000	22,000
57-g-3	Transient housing, Argonne National Laboratory.	533,000	533,000	0
57-g-4	Materials testing reactor maintenance shop, National Reactor Testing Station.	235,000	258,000	(23,000)
57-h-1	Permanent research buildings, Oak Ridge National Laboratory.	5,780,000	5,807,000	(27,000)
57-h-2	Physics building, Brookhaven National Laboratory.	2,140,000	2,140,000	0

See footnotes at end of table.

TABLE 1–A.—*Estimated costs shown in authorizations enacted pursuant to sec. 261 of the Atomic Energy Act of 1954*—Continued

Project No.	Title	Amount authorized	Current estimated cost (May 5, 1958)	Underrun or (overrun)
	PUBLIC LAW 506—continued			
57-h-3	Engineering building, Brookhaven National Laboratory.	$1,879,000	$1,879,000	0
57-h-4	Engineering service building, University of California Radiation Laboratory.	1,080,000	1,080,000	0
57-h-5	Cosmotron target area, Brookhaven National Laboratory.	3,550,000	3,550,000	0
57-h-6	18-inch-cyclotron building, Brookhaven National Laboratory.	300,000	312,000	($12,000)
57-h-7	Addition to heavy ion accelerator building, University of California Radiation Laboratory.	200,000	200,000	0
57-i-1	Reclamation plant and hot laundry, Brookhaven National Laboratory.	400,000	418,000	(18,000)
57-j-1	Real estate development program, Los Alamos, N. Mex.	359,000	359,000	0
57-j-2	Elementary school classrooms, Los Alamos, N. Mex.	195,000	195,000	0
57-k-1	Conversion of barracks for Albuquerque Operations Office headquarters, Sandia Base, Albuquerque N. Mex.	600,000	660,000	(60,000)
57-k-2	Renovation of building for technical information services, Oak Ridge, Tenn.	517,000	568,000	(51,000)
57-l-1	Off-site access roads	2,873,000	2,073,000	800,000
57-m-1	Purchase of Bettis Field property	400,000	400,000	0
	General plant projects	21,000,000	20,888,000	112,000
57-104-1	Emergency replacement of fire damages, Paducah		599,000	
	PUBLIC LAW 141, 84TH CONG., 1ST SESSION			
56-a-1	Production or development plants or facilities.	20,000,000	29,073,000	(9,073,000)
56-b-2	Fast power breeder pilot facility (EBR-II)	29,100,000	29,100,000	0
56-b-3	Surface ship reactor facility	25,000,000	35,000,000	(10,000,000)
56-b-4	Submarine advanced reactor facility	23,140,000	23,140,000	0
56-b-5	Submarine advanced reactor development facilities, Schenectady, N. Y.	3,100,000	3,100,000	0
56-b-6	Aircraft nuclear propulsion program plant and test area, Arco, Idaho.	13,000,000	13,000,000	0
56-b-7	Aircraft reactor test plant	1,437,000	1,070,000	367,000
56-b-8	Modifications and expansions to ANP ground test plant, Idaho.	1,000,000	1,154,000	(154,000)
56-b-9	Special reactor facilities construction program.	2,000,000	811,000	1,189,000
56-b-10	Reactor core test facility, Arco, Idaho	600,000	430,000	170,000
56-c-1 [2]	Particle accelerator program	10,000,000	19,406,000	
56-d-2	Reactor facilities modification, Hanford, Wash.	11,900,000	13,800,000	(1,900,000)
56-d-4	Modifications to separations and processing facilities, Hanford, Wash.	2,560,000	2,466,000	94,000
56-d-6	Barrier plant addition, Oak Ridge, Tenn	2,200,000	1,905,000	295,000
56-d-7	New barrier development plant, Oak Ridge, Tenn.	404,000	490,000	(86,000)
56-e-1	Expansion and modification of ore-processing plant, Monticello, Utah.	1,550,000	825,000	725,000
56-f-3	New Sigma Laboratory, Los Alamos, N. Mex.	5,100,000	5,100,000	0
56-f-4	Detonator production plant	3,750,000	1,899,000	1,851,000
56-f-6	Rocky Flats, Colo., plant and facilities	1,330,000	862,000	468,000
56-f-8	Addition to technical laboratory shop building, Los Alamos, N. Mex.	735,000	609,000	126,000
56-g-1	Engineering test reactor facility	14,350,000	15,343,000	(993,000)
56-g-5	High level chemical development facility, Oak Ridge National Laboratory.	280,000	268,000	12,000
56-g-6	Research reactor, Philippine Government	500,000	500,000	0
56-i-1	Medical research plant and facility, Brookhaven National Laboratory.	6,040,000	6,047,000	(7,000)
56-j-1	Additional housing units, Monticello, Utah	250,000	171,000	79,000
56-j-2	New community hospital, Oak Ridge, Tenn	2,900,000	2,900,000	0
56-j-3	Water and sewer replacements and improvements, Richland, Wash.	160,000	123,000	37,000
56-j-4	Housing program (group 18), Los Alamos, N. Mex.	3,500,000	3,773,000	(273,000)
56-k-1	Offsite access roads	4,165,000	3,900,000	265,000
	General plant projects	17,960,000	17,194,000	766,000
56-104-1	Pressure vessel, beta 2 facility, Oak Ridge, Tenn.		667,000	

[1] Proposed for rescission in fiscal year 1959.
[2] Increase in authorization currently being requested.

TABLE 1-B.—*Current estimated costs of active projects undertaken under authority available to the AEC prior to the enactment of the Atomic Energy Act of 1954, compared with estimated costs shown in a budget justification submitted to the Congress for fiscal year 1955*

Project No.	Title	Estimated in fiscal year 1955 budget to Congress	Current estimated cost (May 5, 1958)	Underrun or (overrun)
	RAW MATERIALS			
101-5006	Offsite access roads	$2,500,000	$2,500,000	0
	SPECIAL NUCLEAR MATERIALS			
224-5003	Improvements, alterations, and additions to existing production facilities.	955,000	838,000	$117,000
224-5066	Expansion and additions to feed materials facilities.	83,000,000	76,033,000	6,967,000
224-5209	Fabrication plant for fuel elements	10,000,000	10,000,000	0
224-4070	Production plant	260,000,000	232,884,000	27,116,000
224-3014B	Renovation of MCW	2,475,000	2,203,000	272,000
224-E3078	Gaseous-diffusion plant and related facilities, Oak Ridge.	350,500,000	258,097,000	92,403,000
224-E3501	Gaseous diffusion plant and related facilities, Paducah.	408,600,000	315,266,000	93,334,000
224-E3701	Gaseous diffusion plant and related facilities, Portsmouth.	1,152,500,000	756,649,000	395,851,000
223	Advance design reactor plant	[1] 280,000	500,000	(220,000)
223-5005	Additional chemical waste storage facilities.	6,000,000	950,000	5,050,000
223-5012	Engineering charging and discharging facilities.	350,000	313,000	37,000
223-5013	Alteration and additions to Hanford 100, 200, and 300 areas.	13,000,000	9,900,000	3,100,000
223-4002	Pile charging and discharging facilities	500,000	500,000	0
223-4022	Pile modification facilities	27,472,000	27,619,000	(147,000)
223-E2061	Plant expansion, Hanford	175,500,000	157,800,000	17,700,000
223-E2062	Separations plant, Hanford	75,000,000	82,750,000	(7,750,000)
223-1073	Production facility, Hanford	64,490,000	64,250,000	240,000
223-9040	Land acquisition, Wahluke slope and other leased land.	[2] 1,244,610	2,754,000	(1,509,390)
	Savannah River projects	1,500,000,000	1,254,262,000	245,738,000
	WEAPONS			
337-5001	Research facilities	4,100,000	5,535,000	(1,435,000)
337-5002	Project Sherwood plant	1,610,000	1,447,000	163,000
331-5016	Plant facilities	5,000,000	3,793,000	1,207,000
331-5013 and 4028	Storage site modifications	1,480,000	999,000	481,000
331-5007	Radiochemistry building	2,095,000	2,196,000	(101,000)
331-3002	Demolition of vacated structures	750,000	430,000	320,000
341-5001	Additions to chemical processing plant.	1,000,000	2,309,000	(1,309,000)
330-4001 and 1007	Weapons construction projects	132,628,013	120,364,000	12,264,013
	REACTOR DEVELOPMENT			
442-5003	Plutonium fabrication facility	[3] 3,000,000	3,991,000	(991,000)
442-4001	Pressurized-water reactor	40,000,000	50,000,000	(10,000,000)
442-4003	Plant modification, Chicago	2,420,000	2,420,000	0
442-4008	3 hot caves, Argonne National Laboratory.	250,000	338,000	(88,000)
442-4015	Breeder program mockup facility	500,000	310,000	190,000
442-4016	Facilities for boiling-water experimental reactor.	750,000	995,000	(245,000)
442-3001	Restoration of Palos Park, ANL	250,000	300,000	(50,000)
442-3006	Zero-power reactor, ANL	700,000	572,000	128,000
442-2001	Submarine thermal reactor	18,000,000	16,350,000	1,650,000
441-5011	Increased chemical processing plant capacity.	10,654,000	11,180,000	(526,000)
441-2016	ANP ground test facilities	16,666,000	14,499,000	2,167,000
441-1031	Chemical processing plant	32,188,400	34,246,000	(2,057,600)
441-0024	Land acquisition	265,000	234,000	31,000
445-5003	Army package power reactor No. 1	2,100,000	1,600,000	500,000
445-4002	Reactor room compartment, SIR, mark B.	18,000,000	18,750,000	(750,000)
445-1001	Submarine intermediate reactor, mark A	27,847,000	27,947,000	(100,000)
424-4025	Engineering test equipment	835,000	835,000	0

[1] Estimate in fiscal year 1957 budget to Congress.
[2] Estimated in fiscal year 1954 budget to Congress.
[3] Estimate in fiscal year 1956 budget to Congress.

TABLE 1–B.—*Current estimated costs of active projects undertaken under authority available to the AEC prior to the enactment of the Atomic Energy Act of 1954, compared with estimated costs shown in a budget justification submitted to the Congress for fiscal year 1955*—Continued

Project No.	Title	Estimated in fiscal year 1955 budget to Congress	Current estimated cost (May 5, 1958)	Underrun or (overrun)
	PHYSICAL RESEARCH			
505–9010	California Institute of Technology, synchrontron.	$810,000	$918,000	($108,000)
524–5029	Multicurie fission products plant, Oak Ridge National Laboratory.	1,544,000	2,223,000	(679,000)
524–1026	Research reactor, ORNL	2,800,000	4,666,000	(1,866,000)
537–4002	Heavy ion accelerator	1,200,000	1,702,000	(502,000)
562–4019	Alternating gradient synchrontron	20,000,000	26,000,000	(6,000,000)
562–4022	Heavy ion accelerator, Yale	1,200,000	1,840,000	(640,000)
537–2002	Electronics research building	[3] 250,000	246,000	4,000
	BIOLOGY AND MEDICINE			
660–5001	General research projects	50,000	62,000	(12,000)
642–9002	Argonne cancer research hospital	4,178,739	4,171,000	7,739
	COMMUNITY			
731–5002	Housing program, group 17, Los Alamos.	1,550,000	1,371,000	179,000
724–9068	Site development, Oak Ridge	1,608,000	1,466,000	142,000
723–4008D	Additional fire station, Richland	95,000	95,000	0
723–3050	Additional grade-school facilities, Richland.	700,000	225,000	475,000
723–9093 and 0052	Additional water supply and sewage facilities.	2,000,000	1,760,000	240,000

TABLE 1–C.—*Other authorized projects*

Title	Authorized	Current cost estimate	Underrun or (overrun)
Public Law 221, 84th Cong., 1st sess.: Projects relating to the disposal of community facilities:			
Oak Ridge	$518,000	$518,000	0
Hanford (as amended by Public Law 802, 84th Cong., 2d sess.)	2,215,000	2,215,000	0
Public Law 31, 84th Cong., 1st sess.: AEC headquarters building (as amended by Public Law 85–107)	13,300,000	13,300,000	0
Public Law 848, 84th Cong., 2d sess.: Nuclear-powered merchant ship	[1]	22,250,000	----------

[1] None stated.

TABLE 2–A. *Active authorized projects on which revised cost estimates have exceeded the authorization limitations after the project has been started*

Project No.	Title	Amount authorized	Allowable cost	Date of start of project	Cost estimate at start of project	Current estimate (May 5, 1958)	Overrun
	PUBLIC LAW 84–141						
56–a–1	Production or development plants or facilities	$20,000,000	$25,000,000	Oct. 21, 1955	$21,741,000	$29,073,000	$4,073,000
56–b–3	Surface ship reactor facility	25,000,000	31,250,000	Apr. 3, 1956	29,800,000	35,000,000	3,750,000
56–c–1 [1]	Particle accelerator program	10,000,000	12,500,000	Nov. 9, 1956	12,300,000	19,406,000	6,906,000
	PUBLIC LAW 84–506						
57–c–4	Small submarine reactor test facility	10,000,000	12,500,000	Feb. 25, 1957	10,000,000	13,500,000	1,000,000
57–c–8	Argonne low-power reactor facility	1,225,000	1,531,250	Apr. 18, 1957	1,300,000	1,904,000	372,750

[1] Increase requested in fiscal year 1959 authorization bill.

TABLE 2–B.—*Active projects undertaken under authority available to the AEC prior to the enactment of the Atomic Energy Act of 1954 on which revised cost estimates have exceeded the authorization limitations after the project has been started*

Project No.	Title	Amount included in 1955 estimates to Congress	Estimated in budget to Congress plus additional allowance	Current estimate		Underrun or overrun
				Date	Amount	
	Advance design reactor plant (Hanford)	[1] $280,000	$378,000	May 5, 1958	$500,000	$122,000
223–9040	Land acquisition—Wahluke Slope and other leased land	[2] 1,244,610	1,680,223	do	2,754,000	1,073,777
341–5001	Addition to chemical processing plant	1,000,000	1,350,000	do	2,309,000	959,000
442–4008	3 hot caves, Argonne National Laboratory	250,000	337,500	do	338,000	500
524–5029	Multicurie fission products plant, Oak Ridge National Laboratory	1,544,000	2,084,400	do	2,223,000	138,600
524–1026	Research reactor, Oak Ridge National Laboratory	2,800,000	3,780,000	do	4,666,000	886,000
537–4002	Heavy ion accelerator	1,200,000	1,620,000	do	1,702,000	82,000
562–4022	Heavy ion accelerator, Yale	1,200,000	1,620,000	do	1,840,000	220,000

[1] Estimate in fiscal year 1957 budget to Congress.

[2] Estimate in fiscal year 1954 budget to Congress.

TABLE 3–A.—*Projects authorized pursuant to sec. 261 of the Atomic Energy Act of 1954 which have been completed*

Project No.	Title	Amount authorized	Date of start of project	Cost estimate at start of project	Final cost	(Overrun) or underrun
	AUTHORIZED BY PUBLIC LAW 141, 84TH CONG.					
56–b–7	Aircraft reactor test plant	$1,437,000	Aug. 23, 1955	$1,437,000	$1,070,000	$367,000
56–d–7	New barrier development plant, Oak Ridge, Tenn	404,000	Feb. 1, 1956	439,000	490,000	(86,000)
56–e–1	Expansion and modification of ore processing plant, Monticello, Utah	1,550,000	Nov. 10, 1955	800,000	825,000	725,000
56–e–2	Storage sites for vanadium bearing tailings	500,000			22,000	478,000
56–f–5	Base construction, Pacific proving ground	1,568,000	Oct. 1, 1955	1,568,000	1,569,000	(1,000)
56–f–6	Rocky Flats, Colo., plant and facilities	1,330,000	Aug. 22, 1955	1,330,000	862,000	468,000
56–f–7	Base construction, Nevada test site	927,000	Apr. 6, 1956	927,000	807,000	120,000
56–f–8	Addition to technical laboratory shop building, Los Alamos, N. Mex	735,000	May 3, 1956	655,000	570,000	165,000
56–g–1	Engineering test reactor facility	14,350,000	Oct. 13, 1955	15,000,000	15,343,000	(993,000)
56–g–4	Reactor engineering building addition, Argonne National Laboratory	295,000	Oct. 17, 1955	324,500	324,000	(29,000)
56–g–5	High level chemical development facility, Oak Ridge National Laboratory	280,000	Aug. 27, 1956	300,000	267,000	13,000
56–h–1	Conversion of existing building to development plant, Oak Ridge National Laboratory.	1,150,000	Aug. 22, 1956	150,000	149,000	1,001,000
56–h–2	Fabrication plant for development equipment, Oak Ridge National Laboratory	440,000	Apr. 16, 1956	440,000	474,000	(34,000)
56–j–1	Additional housing units, Monticello, Utah	250,000	Oct. 4, 1956	170,000	171,000	79,000
56–j–3	Water and sewer replacements and improvements, Richland, Wash	160,000	Oct. 30, 1956	133,000	119,000	41,000
56–j–4	Housing program (group 18), Los Alamos, N. Mex	3,500,000	May 22, 1956	3,823,000	3,737,000	(237,000)
	AUTHORIZED BY PUBLIC LAW 506, 84TH CONG.					
57–e–1	Analytical laboratory addition, Grand Junction, Colo	362,000	Oct. 18, 1956	369,000	322,000	40,000
57–f–5	Base construction, Nevada test site	543,000	Dec. 24, 1956	597,000	597,000	(54,000)
57–f–7	Warehouse, Sandia	308,000	Mar. 28, 1957	338,000	258,000	50,000
57–f–9	Programing building, Livermore, Calif	180,000	Mar. 18, 1957	180,000	180,000	0
57–g–3	Transient housing, Argonne National Laboratory	533,000	June 14, 1957	533,000	533,000	0
57–g–4	Materials testing reactor maintenance shop, National Reactor Testing Station	235,000	Jan. 31, 1957	258,500	258,000	(23,000)
57–j–2	Elementary school classrooms, Los Alamos, N. Mex	195,000	Nov. 21, 1956	195,000	194,000	1,000
57–k–1	Conversion of barracks for Albuquerque Operations Office headquarters, Sandia Base, Albuquerque, N. Mex.	600,000	June 10, 1957	660,000	662,000	(62,000)
57–k–2	Renovation of building for technical information services, Oak Ridge, Tenn	517,000	Oct. 29, 1956	568,000	560,000	(43,000)

TABLE 3–B.—*Projects undertaken under authority available to the Atomic Energy Commission prior to the enactment of the Atomic Energy Act of 1954 to be completed within the current fiscal year*

Project No.	Title	Estimated in fiscal year 1955 budget to Congress	Final cost	Underrun or (overrun)
224-5003	Improvements, alterations and additions to existing production facilities.	$955,000	$838,000	$117,000
224-4070	Production plant	260,000,000	232,886,000	27,114,000
224-3014b	Renovation of Mallinckrodt Chemical works	2,475,000	2,203,000	272,000
224-E3078	Gaseous diffusion plant and related facilities, Oak Ridge.	350,500,000	258,096,000	92,404,000
224-E3501	Gaseous diffusion plant and related facilities, Paducah.	408,600,000	315,266,000	93,334,000
223-4002	Pile charging and discharging facilities	500,000	500,000	0
331-5016	Plant facilities	5,000,000	3,793,000	1,207,000
331-5007	Radiochemistry building	2,095,000	2,192,000	(97,000)
442-4015	Breeder program mockup facility	500,000	310,000	190,000
442-4016	Facilities for boiling water reactor	750,000	995,000	(245,000)
442-3001	Restoration of Palos Park, Argonne National Laboratory.	250,000	300,000	(50,000)
441-2016	Aircraft nuclear propulsion ground test facilities.	16,666,000	14,499,000	2,167,000
441-1031	Chemical processing plant	32,188,400	34,246,000	(2,057,600)
445-1001	Submarine intermediate reactor, mark A	27,847,000	27,947,000	(100,000)
537-4002	Heavy ion accelerator	1,200,000	1,702,000	(502,000)
562-4022	Heavy ion accelerator, Yale	1,200,000	1,835,000	(635,000)
660-5001	General research projects	50,000	62,000	(12,000)
660-5001	General research projects	50,000	62,000	(12,000)
642-9002	Argonne cancer research hospital	4,178,739	4,165,000	13,739
731-5002	Housing program, group 17, Los Alamos	1,550,000	1,370,000	180,000
724-9068	Site development	1,608,000	1,465,000	143,000
723-4008D	Additional fire station, Richland	95,000	95,000	0
723-9093-0052	Additional water supply and sewage facilities.	2,000,000	1,760,000	240,000

TABLE 4.—*Current unliquidated obligations on projects for which authorization was rescinded by Public Law 85–162*

Project No.	Title	Amount authorized	Unliquidated obligations, Mar. 31, 1958
	AUTHORIZED BY PUBLIC LAW 141, 84TH CONG.		
56-b-1	Power reactor development acceleration project	$25,000,000	0
56-d-1	Metallex pilot facility, Oak Ridge National Laboratory	1,000,000	0
56-d-3	Special reactor facilities equipment, Hanford, Wash.	5,600,000	0
56-d-5	Conversion of pilot plant and facility to production plant and facility, Fernald, Ohio.	600,000	0
56-d-8	Expansion of metal recovery facility, Oak Ridge National Laboratory.	370,000	0
56-f-1	Art construction project, fiscal year 1956 increment	17,873,000	0
56-f-2	Expansion of weapons material fabrication plant and facility.	15,000,000	0
56-g-2	Reactor training school, Argonne National Laboratory	712,000	0
56-g-3	Chemistry cave for radioactive materials, Argonne National Laboratory.	448,000	0
56-g-7	Research reactors for the development of peacetime uses of atomic energy under agreements for cooperation.	5,000,000	0
	AUTHORIZED BY PUBLIC LAW 506, 84TH CONG.		
57-a-1	Additional feed materials, plant	22,200,000	0
57-a-8	Chemical processing facility, St. Louis, Mo	1,600,000	0
57-a-9	Barrier plant automation, Oak Ridge, Tenn	1,400,000	0
57-a-10	Reactor temperature test installation, Hanford, Wash.	900,000	0
57-a-11	Improvements to reactor cooling water effluent system, Hanford, Wash.	550,000	0
57-a-12	Fuel element heat-treating plant, Fernald, Ohio	500,000	0
57-c-10	Amended reactor development project	15,000,000	0
57-f-6	Manufacturing support plant, Kansas City, Mo	444,000	0
57-f-8	Mechanical shop additions, Livermore, Calif.	300,000	0

TABLE 5.—*Projects authorized pursuant to sec. 261 of the Atomic Energy Act of 1954 which have been abandoned, substituted for, or superseded by revised authorizations*

Project No.	Title	Estimate in authorization act
	Public Law 85-162:	
58-b-1	Fabrication plant	[1] $5,000,000
58-b-3	Metal treatment plant, Fernald, Ohio	[2] 850,000
58-e-13	Argonne boiling reactor (Arbor), National Reactor Testing Station, Idaho.	[3] 8,500,000
57-c-6	Public Law 84-506: Food irradiation facility	[4] 3,000,000

[1] Present technology is not sufficiently advanced to warrant proceeding with design of the proposed plant.
[2] Economies attributable to the proposed plant are no longer attractive due to improved processing facilities at the Fernald Materials Processing Center.
[3] Based on a recent program reexamination, it has been determined not to proceed with a project of this scope at this time.
[4] This project is being abandoned since the Department of Defense favors an irradiated-cobalt facility which will be funded by that Department. Reference is made to the letter of Mar. 18, 1958, from the Chairman, Atomic Energy Commission, to the chairman, Joint Committee on Atomic Energy, on this subject.

TABLE 6.—*Projects which had not been started as of Mar. 31, 1958*

Project No.	Title	Authorized amount	Explanation
	AUTHORIZED BY PUBLIC LAW 85-162	*Thousands*	
58-b-1	Fabrication plant	$5,000	Proposed for rescission in 1959 authorization bill.
58-b-3	Metal treatment plant, Fernald, Ohio	850	Do.
58-b-4	Improvements to production and supporting installations, Hanford, Wash., and Savannah River, S. C.	10,000	Design underway.
58-b-5	Additions to scrap plants, various sites	1,500	Expect to start in 1959.
58-b-6	Additions to gaseous diffusion plants	6,600	Deferred until after 1959; not immediately required due to rescheduling cascade improvements program.
58-b-7	Reduction in fire hazards—gaseous diffusion plants, Oak Ridge, Paducah, and Portsmouth.	12,000	Design underway; portion of construction is out for bids.
58-c-2	Weapons special component plant	6,000	Deferred until after 1959 due to revised programmatic requirements.
48-d-2	Storage site modifications	2,000	Construction to be undertaken by the Army.
58-d-3	High-explosive development plant, Livermore, Calif.	2,100	Design underway.
58-d-5	Ventilation system replacements, Los Alamos, N. Mex.	618	Do.
58-d-6	Reclamation foundry, shop, and warehouse, Sandia base, New Mexico.	308	Deferred until after 1959; scope and location being revaluated.
58-d-7	Reactor, area III, Sandia base, New Mexico	2,900	Design underway.
58-d-8	Base construction, Nevada test site	350	Do.
58-e-3	Fuels technology center, Argonne National Laboratory, Illinois.	10,000	Do.
58-e-4	Modifications and additions, aircraft nuclear propulsion ground test plant, area No. 1, National Reactor Testing Station, Idaho.	8,000	Do.
58-e-5	Test installations for classified project	9,000	Do
58-e-7	Waste calcination system, National Reactor Testing Station, Idaho.	4,000	Do.
58-e-8	Hot cells	3,500	Do.
58-e-9	High-temperature test installation, Bettis plant, Pennsylvania.	3,000	Do.
58-e-10	Destroyer reactor development plant	750	Construction expected to begin in 4th quarter of fiscal year 1958.
58-e-11	Sodium reactor experiment (SRE) modification, Santa Susana, Calif.	4,700	Only $500,000 appropriated; expect to start in 1958.
58-e-12	Liquid metal fuel reactor experiment (LMFRE)	17,500	Deferred until after 1959; scope being reevaluated.
58-e-13	Argonne boiling reactor (Arbor), National Reactor Testing Station, Idaho.	8,500	Proposed for rescission in 1959 authorization bill.

TABLE 6.—*Projects which had not been started as of Mar. 31, 1958*—Continued

Project No.	Title	Authorized amount	Explanation
	AUTHORIZED BY PUBLIC LAW 85-162	*Thousands*	
58-e-15	Plutonium recycle experimental reactor design for the production of 15,000 electrical kilowatt equivalent.	$15,000	Design underway; procurement has been initiated.
58-f-2	Hot pilot plant	2,000	Design to begin in 1958; construction in 1959.
58-f-3	Land acquisition, National Reactor Testing Station, Idaho.	1,000	Funds have been advanced to the Corps of Engineers.
58-g-1	Accelerator improvements, University of California Radiation Laboratory, California.	875	Design underway.
58-h-1	Reactor improvements, Argonne National Laboratory, Illinois.	380	Do.
58-i-1	Mammalian radiation injury and recovery area, Oak Ridge National Laboratory, Tennessee.	475	Design underway; portion of construction is out for bid.
58-j-1	Nuclear training project, Regional Nuclear Training Center, P. R.	2,500	Do.
58-k-1	Schools, Los Alamos, N. Mex	965	Design underway; expect to start construction in 1958.
58-k-2	Housing modifications, Los Alamos, N. Mex	1,000	Do.
58-k-3	Additional water well, Los Alamos, N. Mex	138	No appropriation in 1958; expect to start in 1959.
	AUTHORIZED BY PUBLIC LAW 85-506		
57-a-3	Improved high-level waste-handling system, Savannah River.	5,000	Deferred due to changes in programatic requirements.
57-a-6	Charging and discharging system, Hanford, Wash.	3,450	Deferred pending further technical development.
57-c-1	Aircraft nuclear propulsion ground test plant, area No. 2, Idaho.	55,000	Preliminary design completed; construction deferred pending program developments.
57-c-6	Food irradiation facility	3,000	Proposed for rescission in 1959 authorization bill.
57-c-9	Materials testing reactor hot cell extension, National Reactor Testing Station.	310	Design to start in 1958; construction in 1959.
57-d-1	High energy accelerator	27,000	Design underway.
57-d-4	Conversion of accelerator design building, University of California Radiation Laboratory.	300	Deferred until after 1959; not immediately essential to progress in the atomic energy field.
57-f-1	Metallurgy Laboratory, Livermore, Calif	2,270	Design underway.
57-h-1	Permanent research buildings, Oak Ridge National Laboratory.	5,780	Deferred until after 1959; not immediately essential to progress in the atomic energy field.
57-h-2	Physics building, Brookhaven National Laboratory.	2,140	Do.
57-h-3	Engineering building, Brookhaven National Laboratory.	1,879	Do.
57-h-4	Engineering service building, University of California Radiation Laboratory.	1,080	Do.
57-j-1	Real estate development program, Los Alamos, N. Mex.	359	Design underway; expect to start construction in 1958.
	AUTHORIZED BY PUBLIC LAW 84-141		
56-g-6	Research reactor, Philippine Government	500	Awaiting formal request from Philippine Government.

TABLE 7.—*Analysis of unexpended balances projected for June 30, 1958*

	Millions
Plant acquisition and construction:	
Unexpended balance of appropriations estimated at June 30, 1958	$485.4
Portion estimated to be obligated at June 30, 1958	309.0
Portion estimated to be unobligated at June 30, 1958:	
Projects now estimated to carry over to fiscal year 1959	111.0
Funds reserved to apply against fiscal year 1959 obligational requirements	65.4
Total	485.4
Operating expenses:	
Unexpended balance of appropriations estimated at June 30, 1958	893.8
Portion estimated to be obligated at June 30, 1958	851.2
Goods and services on order:	
Operation of facilities	512.1
Major procurement	57.3
Research and development in outside facilities	26.6
Cooperative arrangements	43.3
Utility contracts	1.6
All other	33.1
Total	674.0
Goods and services received but not paid for	177.2
Portion estimated to be unobligated at June 30, 1958, to be applied against fiscal year 1959 obligational requirements	42.6
Total	893.8

TABLE 8.—*Comparison of items submitted to the Bureau of the Budget with items submitted to the Congress (revised May 13, 1958)*

Project title	Original submission by AEC	President's budget	Amendment proposed by AEC	Submitted to Congress	
				Fiscal year 1958	Fiscal year 1959
Improvements to production and supporting installations, Hanford, Wash., and Savannah River, S. C	$5,000,000	$5,000,000	0	0	0
Purification systems, undetermined sites	4,000,000	4,000,000	0	0	0
Plant modifications for processing of nonproduction spent fuels, undetermined sites	15,000,000	15,000,000	0	0	$15,000,000
Pilot plant for fabrication of new fuel elements, Fernald, Ohio	335,000	335,000	0	0	335,000
Reduction of fire hazards, phase II, gaseous-diffusion plants, Oak Ridge, Paducah, and Portsmouth	7,900,000	7,900,000	$4,000,000	0	11,900,000
New waste-storage installations, Arco, Idaho	6,000,000	3,200,000	0	0	3,200,000
Weapons production and development plant, locations undetermined	5,000,000	5,000,000	5,000,000	0	10,000,000
Component fabrication plant, Hanford, Wash	3,500,000	3,500,000	0	0	3,500,000
Fabrication plant, Oak Ridge, Tenn	12,500,000	12,500,000	0	0	12,500,000
Storage-site modification, various locations	1,500,000	1,500,000	0	0	1,500,000
Special processing plant, Mound Laboratory, Ohio	2,000,000	2,000,000	0	0	2,000,000
Base construction, Eniwetok Proving Ground	2,342,000	2,342,000	0	0	2,342,000
Base construction, Nevada test site	1,780,000	1,780,000	0	0	1,780,000
Test area development, Nevada test site	600,000	600,000	0	0	600,000
Phermex facility, Los Alamos, N. Mex	2,250,000	2,250,000	0	0	2,250,000
Laboratory building, TA-33, Los Alamos, N. Mex	590,000	590,000	0	0	590,000
Test and environmental facilities Sandia	1,488,000	1,488,000	0	0	1,488,000
Lineal acceleration tester, Livermore, Calif	390,000	390,000	0	0	390,000
Test assembly building	510,000	510,000	0	0	510,000
High explosive development plant, Livermore, Calif	2,000,000	2,000,000	0	0	2,000,000
Storage and handling building, Livermore, Calif	250,000	250,000	0	0	250,000
Project Sherwood	0	0	5,250,000	$2,250,000	2,000,000
Gas-cooled power reactor	0	0	51,000,000	0	51,000,000

TABLE 8.—*Comparison of items submitted to the Bureau of the Budget with items submitted to the Congress (revised May 13, 1958)*—Continued

Project title	Original submission by AEC	President's budget	Amendment proposed by AEC	Submitted to Congress	
				Fiscal year 1958	Fiscal year 1959
Reprocessing pilot plant, ORNL	$3,500,000	$3,500,000	0	0	$3,500,000
Special-purpose test facility	2,300,000	2,300,000	0	0	2,300,000
Fast reactor safety testing station, Nevada test site	2,867,000	2,867,000	−$1,500,000	0	1,367,000
Army reactor experimental area (AREA), Idaho	1,000,000	1,000,000	0	0	1,000,000
Hot cells	3,500,000	3,500,000	1,500,000	0	5,000,000
Department of Defense small plant reactors	0	0	30,000,000	0	0
Army package power reactor No. 2	0	0	3,000,000	0	3,000,000
Tanker propulsion plant	0	0	7,000,000	0	0
Destroyer reactor plant, West Milton, N. Y.	35,000,000	35,000,000	0	$35,000,000	0
Modifications to organic moderated reactor experiment (OMRE), experimental boiling water reactor (EBWR), and boiling reactor experiment (BORAX)	0	0	6,300,000	0	6,300,000
Heavy-water power reactor	0	0	65,000,000	0	0
Heavy-water component test reactor	0	0	8,000,000	0	8,000,000
Fuels technology center addition, Argonne National Laboratory, Illinois	0	0	5,000,000	0	5,000,000
Materials and engineering test reactors	0	0	35,000,000	0	0
Modifications and additions, aircraft nuclear propulsion ground test plant, area numbered 1, National Reactor Testing Station, Idaho	0	0	1,500,000	0	0
Argonne boiling reactor (ARBOR)	0	0	5,000,000	0	0
Accelerator improvements, University of California Radiation Laboratory, California	500,000	500,000	0	0	500,000
CP-5 reactor improvements, Argonne National Laboratory, Illinois	0	0	500,000	0	500,000
Metals process development plant, Ames, Iowa	0	0	1,900,000	0	0
Metals and ceramics research buildings, Oak Ridge National Laboratory, Tennessee	0	0	6,500,000	0	0
Particle accelerator program	0	0	9,406,000	9,406,000	0
Facilities for support of research dealing with radioactive fallout and related radiation hazards	2,000,000	2,000,000	0	0	2,000,000
Additional facilities for the regional nuclear center, Puerto Rico	500,000	500,000	0	0	500,000
International Atomic Energy Agency research reactor and laboratories	1,500,000	1,500,000	500,000	0	2,000,000
Gamma process development irradiator	0	0	1,600,000	0	1,600,000
Intermediate school facilities, Los Alamos, N. Mex	150,000	150,000	−150,000	0	0
School storage building, Hanford, Wash	75,000	75,000	0	0	75,000
General plant projects	25,802,000	25,602,000	0	0	25,602,000

NOTE.—In addition, AEC representatives indicated that an item of $120,000,000 for a new production reactor, Hanford, Wash., was discussed with the Bureau of the Budget and subsequently withdrawn by AEC.

Representative HOLIFIELD. Last Friday, May 9, 1958, the Joint Committee received three letters from the AEC forwarding proposed bills. Two of these proposed bills amended prior authorization acts, and the third was a proposed authorization bill for the fiscal year 1959 program. Without objection, I would like to insert in the record at this point copies of the three AEC letters.

(The letters referred to follow:)

ATOMIC ENERGY COMMISSION,
Washington, D. C., May 8, 1958.

HON. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: I have today transmitted to the Speaker of the House of Representatives and the President of the Senate proposed legislation which would amend the 1956 and 1958 authorization acts.

Amendments to section 101 of the 1958 authorization act are proposed to increase the total current authorization for appropriations by $2,250,000 and to provide for the same increase in authorized costs for Project Sherwood construction. The present authorization for Project Sherwood construction at Liver-

more and Princeton is $7,750,000. The current estimate of the cost of construction at Livermore is $1,400,000, for which design work is now underway. The first phase of the project at Princeton which includes office, laboratory, and other supporting installations now estimated to cost $2,075,000 is also underway. The project at Princeton has now advanced to the point where construction of the building to house the model C device and supporting installation should be initiated. However, the currently estimated cost of this phase of the project is $6,525,000, increasing the total cost of the overall project at both locations to $10 million, which is in excess of the amount currently authorized plus the allowable increase of 25 percent. In order to proceed promptly with the building to house the model C device an increase of $2,250,000 in the authorization for this project is requested.

The amendment proposed to the 1956 authorization act would increase the amount authorized for project 56–c–1, for a particle accelerator program, from $10 million to $19,406,000. The authorization was for the construction of two accelerators at university sites under proposals acceptable to the Commission. Of the 2 proposals accepted, 1 was submitted by Harvard University and Massachusetts Institute of Technology for a 6-b. e. v. electron accelerator and supporting facilities to be located at Cambridge, Mass., estimated to cost $6.5 million; the other was submitted by a Princeton University and University of Pennsylvania group for a 3-b. e. v. proton accelerator and supporting facilities to be located at Princeton, N. J., at an estimated cost to the Government of $5.8 million, with a contribution by the universities of $0.5 million. The total estimated cost to the Government of the 2 proposals amounted to $12.3 million, which was within the authorized amount of $10 million plus the allowable increase of 25 percent.

The Harvard project, including the construction of the accelerator and related facilities is now underway. A recent review of the project costs, however, indicates that the cost to complete will total $8.2 million, or an increase of $1.7 million over the previous estimate.

On the Princeton-Pennsylvania project, the construction of the laboratory and office space has been started and will be completed within the original estimates for those buildings. Construction of the accelerator except for procurement of long lead-time components and the building to house the accelerator has not been started as design work on the accelerator has been more complex than originally estimated. Based on the design work done to date, however, it is now apparent that the accelerator and housing cannot be completed within the original estimate. The current estimated cost for this project totals $11.2 million, exclusive of any contribution by the universities, as compared to the original estimate of $5.8 million. The Commission believes that the planned Princeton accelerator is an urgently required tool for research in the field of high energy physics, and that this machine should go forward. In view of the large increase in cost for this machine and related housing the Commission believes that the increased authorization should be provided.

The current estimate of the cost of the Harvard-MIT and the Princeton-Pennsylvania projects now totals $19.4 million, or an increase of $9.4 million above the original authorization. Since construction work on the Princeton accelerator is not going forward, pending revised authorization, we request your early consideration of this and the increase for the Sherwood project.

Enclosed are copies of the proposed legislation, a section-by-section analysis, and project data sheets.

Sincerely yours,

(Signed) W. F. LIBBY,
(For Chairman).

ATOMIC ENERGY COMMISSION,
Washington, D. C., May 9, 1958.

HON. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: I have submitted today to the Speaker of the House of Representatives and the President of the Senate proposed legislation which would amend the 1958 authorization act (Public Law 85–162) to increase the amounts authorized for cooperative agreements under the civilian power reactor demonstration program and to effect certain changes in the provisions relating to such authorizations. The proposed legislation includes provisions relating to the waiver of charges for the use of heavy water and to the proposal submitted by the East Central Nuclear Group and the Florida West Coast

Nuclear Group, which were previously included in the proposed legislation submitted to the Congress on February 28, 1958, but which to date have not been reported to the Congress.

In summary, the proposed legislation would further amend Public Law 85–162 as follows:

1. Section III would be amended to increase the current authorization for appropriations for cooperative agreements from $129,915,000 to $133,863,000 and to increase the total assistance authorized from $149,915,000 to $153,863,000. These increases are necessary to cover the total amounts required under agreements entered into to date plus those currently under consideration. The analysis of the bill transmitted with this letter contains a table showing the current estimate of appropriations required for funding the Commission's participation under each of the agreements and which total $133,863,000.

2. Section 111 would be amended to permit the waiver of charges for the use of heavy water in any reactor under the Commission's power reactor demonstration program.

1. Section 111 would be amended to increase the current authorization for appappropriated to the Commission pursuant to the authorization in subsection 111 (a) of Public Law 85–162 and authorized for the third round of the Commission's power reactor demonstration program in a cooperative arrangement for an advanced high temperature, gas-cooled, heavy water moderated reactor as described in program justification data No. 58–111–5, transmited with our letter of February 28, 1958.

4. Section 111 would also be further amended to permit the utilization of funds appropriated to the Commission pursuant to the authorization in subsection 111 (a) of Public Law 85–162 for phase I of the cooperative arrangement with the Pennsylvania Power & Light Co. and Westinghouse Electric Corp., as set forth in program justification data No. 58–111–6 (phase I) which is submitted with this letter. A separate authorization for phase II of this project would be requested at a later date, if the proposers and the Commission were to desire to proceed with that phase of the project. Upon enactment of this amendment, we understand, that the Commission would be authorized to proceed with phase I of the proposed arrangement without further submission of the basis for the arrangement to your committee and that the requirements of section 111 (b) would not be applicable.

With regard to the patent matters discussed in the hearings of March 22 and referred to in your letter of March 28, we have held further discussions with the proposers with the following results:

1. It has been agreed that the Atomic Energy Commission would have option, in lieu of a refund by the companies of funds spent by the Commission for phase I work, to retain instead ownership of all inventions made during phase I, granting to the companies an irrevocable, royalty-free, nonexclusive license with a nonexclusive right to grant nonexclusive sublicenses as to foreign patents on such inventions. This would make possible the protection of the Government's interest in cases where the patent rights, which the proposers would receive as a result of the rebate, appeared to be of greater value than the amount of the repayments.

2. With regard to inventions arising out of the work supported wholly by the companies during the period July 1955 to December 31, 1957, it was agreed that the Atomic Energy Commission would receive a nonexclusive, irrevocable, royalty-free license for Government use in any atomic energy inventions arising during this period.

The above agreements have been incorporated in the revised program justification data which is transmitted to you herewith.

At this point, it might be appropriate to refer to our letter of April 15, 1958, which notified you of the recent transfer of fluid between the core and blanket region of the homogeneous reactor experiment No. 2 at Oak Ridge. We would like to make it clear that this incident, involving the 2-region HRE–2, bears no direct relationship from an engineering standpoint to the Pennsylvania Power & Light and Westinghouse reactor, which is a single-region reactor with a slurry-type fuel and therefore employs neither a zircaloy core vessel nor a uranyl-sulfate solution.

Copies of the proposed legislation, an analysis of the amendments proposed, and program justification data No. 58–111–6, phase I, are enclosed. Program justification data No. 58–111–5 was furnished with our letter of February 28, 1958.

These amendments relating to the current civilian power reactor demonstration program are submitted separately from the 1959 authorization bill in the

hope that they will have the early attention of your committee and enactment by the Congress so that the Commission may proceed promptly with arrangements now under consideration.

Sincerely yours,

W. F. LIBBY, *Acting Chairman.*

ATOMIC ENERGY COMMISSION,
Washington, D. C., May 9, 1958.

HON. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: I have submitted today to the Speaker of the House of Representatives and the President of the Senate proposed legislation in accordance with the provisions of section 261 of the Atomic Energy Act of 1954, as amended, to authorize appropriations for the Commission's 1959 plant acquisition and construction program and to further increase the amount of appropriations authorized for cooperative arrangements under the Commission's civilian power reactor demonstration program.

In summary, the proposed legislation includes the following:

1. Authorization of appropriations for the 1959 plant acquisition and construction program in the amount of $193,379,000;

2. An increase in appropriations for cooperative arrangements under the civilian power reactor demonstration program of $22,809,000. The increase from $133,863,000 to $156,672,000, as indicated in the proposed legislation, is predicated on the prior enactment of the increase being requested separately as a 1958 amendment;

3. An increase in the limitation on certain expenses related to the move to the new office at Germantown from $75,000 to $210,000; and

4. Revision of previous project authorizations totaling $17,350,000.

Attached hereto are copies of the proposed bill and an unclassified analysis in support of the proposed provisions. A classified analysis, containing additional information, is being transmitted separately to your staff.

Sincerely yours,

W. F. LIBBY, *Acting Chairman.*

Representative HOLIFIELD. On Monday of this week, May 12, 1958, Mr. Durham, by request, introduced the three proposed bills in the House of Representatives, which were designated as H. R. 12457 (amending prior acts to provide increases in the Project Sherwood and particle accelerator programs), H. R. 12458 (amending section 111 of the current fiscal year 1958 act concerning the cooperative power reactor demonstration program), and H. R. 12459 (the authorization request by AEC for the fiscal year 1959 program). Without objection, I would like to have printed in the record at this point copies of H. R. 12457, 12458, and 12459.

(The bills referred to follow:)

[H. R. 12457, 85th Cong., 2d sess.]

A BILL To further amend Public Law 85–162 and Public Law 84–141, to increase the authorization for appropriations to the Atomic Energy Commission in accordance with section 261 of the Atomic Energy Act of 1954, as amended, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 101 of Public Law 85–162, as amended, is further amended by striking therefrom the figure "$257,230,000" and inserting in lieu thereof the figure "$259,480,000".

SEC. 2. Section 101 (a) of Public Law 85–162 is amended by striking therefrom the figure "$7,750,000" for project 58–e–6, project Sherwood plant, and substituting therefor the figure "$10,000,000".

SEC. 3. Section 101 (c) of Public Law 84–141, as amended, is further amended by striking therefrom the figure "$10,000,000" for project 56–c–1, particle accelerator program, and substituting therefor the figure "$19,406,000".

[H. R. 12458, 85th Cong., 2d sess.]

A BILL To further amend Public Law 85–162, as amended, to increase the authorization for appropriations to the Atomic Energy Commission in accordance with section 261 of the Atomic Energy Act of 1954, as amended, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 111 of Public Law 85–162 is hereby amended by striking the figures "$129,915,000" and "$149,915,000" from section 111 (a) and inserting in lieu thereof the figures "$133,863,000" and "$153,863,000", and by adding at the end thereof the following:

"(c) Funds appropriated to the Commission, pursuant to the authorization contained in subsection (a) of this section shall be available to the Commission for cooperative arrangements which may provide for the waiver by the Commission of its charges for the use of heavy water for a period not to exceed five years in any proposed reactor otherwise eligible for assistance under the Commission's power reactor demonstration program.

"(d) Funds appropriated to the Commission, pursuant to the authorization contained in subsection (a) of this section and authorized for the Third Round of the Commission's power reactor demonstration program, shall be available to the Commission for a cooperative arrangement in accordance with the basis for an arrangement described in the Program Justification Data for Arrangement No. 58–111–5.

"(e) Funds appropriated to the Commission pursuant to the authorization contained in subsection (a) of this section, for the Commission's power reactor demonstration program, shall be available to the Commission for a cooperative arrangement in accordance with the basis for an arrangement described in the Program Justification Data for Arrangement No. 58–111–6 (PHASE I)."

[H. R. 12459, 85th Cong., 2d sess.]

A BILL To authorize appropriations for the Atomic Energy Commission in accordance with section 261 of the Atomic Energy Act of 1954, as amended, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SEC. 101. PLANT OR FACILITY ACQUISITION OR CONSTRUCTION.—There is hereby authorized to be appropriated to the Atomic Energy Commission, in accordance with the provisions of section 261 a. (1) of the Atomic Energy Act of 1954, as amended, the sum of $193,379,000 for acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, as follows:

(a) SPECIAL NUCLEAR MATERIALS.—

1. Project 59–a–1, plant modifications for processing of nonproduction spent fuels, undetermined sites, $15,000,000.

2. Project 59–a–2, pilot plant for fabrication of new fuel elements, Fernald, Ohio, $335,000.

3. Project 59–a–3, reduction of fire hazards—phase II gaseous diffusion plants, Oak Ridge, Paducah, and Portsmouth, $11,900,000.

4. Project 59–a–4, new waste storage installations, Arco, Idaho, $3,200,000.

(b) ATOMIC WEAPONS.—

1. Project 59–b–1, weapons production and development plants, locations undetermined, $10,000,000.

2. Project 59–b–2, component fabrication plant, Hanford, Washington, $3,500,000.

3. Project 59–b–3, fabrication plant, Oak Ridge, Tennessee, $12,500,000.

4. Project 59–b–4, special processing plant, Mound Laboratory, Ohio, $2,000,000.

(c) ATOMIC WEAPONS.—

1. Project 59–c–1, storage site modifications, various locations, $1,500,000.

2. Project 59–c–2, base construction, Eniwetok Proving Ground, $2,342,000.

3. Project 59–c–3, base construction, Nevada Test Site, $1,780,000.

4. Project 59–c–4, test area development, Nevada Test Site, $600,000.

5. Project 59–c–5, phermex installation, Los Alamos, New Mexico, $2,250,000.

6. Project 59–c–6, laboratory building, TA–33, Los Alamos, New Mexico, $590,000.

7. Project 59–c–7, test and environmental installations, Sandia Base, New Mexico, $1,488,000.

8. Project 59–c–8, lineal acceleration tester, Livermore, California, $390,000.

9. Project 59–c–9, test assembly building, $510,000.

10. Project 59–c–10, high explosive development plant, Livermore, California, $2,000,000.

11. Project 59–c–11, storage and handling building, Livermore, California, $250,000.

(d) REACTOR DEVELOPMENT.—

1. Project 59–d–1, reprocessing pilot plant, Oak Ridge National Laboratory, Tennessee, $3,500,000.

2. Project 59–d–2, special purpose test installation, $2,300,000.

3. Project 59–d–3, fast reactor safety testing station, Nevada test site, $1,367,000.

4. Project 59–d–4, Army reactor experimental area (AREA), Arco, Idaho, $1,000,000.

5. Project 59–d–5, hot cells, $5,000,000.

6. Project 59–d–6, Army package power reactor No. 2, $3,000,000.

7. Project 59–d–7, modifications to organic moderated reactor experiment (ORME), experimental boiling water reactor (EBWR), and boiling reactor experiment (BORAX), $6,300,000.

8. Project 59–d–8, heavy water component test reactor, $8,000,000.

9. Project 59–d–9, fuels technology center addition, Argonne National Laboratory, Illinois, $5,000,000.

10. Project 59–d–10, gas-cooled power reactor, $51,000,000.

11. Project 59–d–11, Project Sherwood plant, $2,000,000.

(e) PHYSICAL RESEARCH.—

1. Project 59–e–1, accelerator improvements, University of California Radiation Laboratory, California, $500,000.

2. Project 59–e–2, CP–5 reactor improvements, Argonne National Laboratory, Illinois, $500,000.

(f) BIOLOGY AND MEDICINE.—

1. Project 59–f–1, installations for support of research dealing with radioactive fallout and related radiation hazards, $2,000,000.

(g) TRAINING, EDUCATION, AND INFORMATION.—

1. Project 59–g–1, additional plant for the Regional Nuclear Training Center, Puerto Rico, $500,000.

2. Project 59–g–2, International Atomic Energy Agency research reactor and laboratories, $2,000,000.

3. Project 59–g–3, gamma process development irradiator, $1,600,000.

(h) COMMUNITY.—

1. Project 59–h–1, school storage buildings, Hanford, Washington, $75,000.

(i) GENERAL PLANT PROJECTS.—$25,602,000.

SEC. 102. LIMITATIONS.—(a) The Commission is authorized to start any project set forth in subsections 101 (a), (b), (d), (e), (f), and (g) only if the currently estimated cost of that project does not exceed by more than 25 per centum the estimated cost set forth for that project.

(b) The Commission is authorized to start any project set forth in subsections 101 (c) and (h) only if the currently estimated cost of that project does not exceed by more than 10 per centum the estimated cost set forth for that project.

(c) The Commission is authorized to start a project under subsection 101 (i) only if it is in accordance with the following:

1. For community operations, the maximum currently estimated cost of any project shall be $100,000 and the maximum currently estimated cost of any building included in such project shall be $10,000.

2. For all other programs, the maximum currently estimated cost of any project shall be $500,000 and the maximum currently estimated cost of any building included in such a project shall be $100,000.

3. The total cost of all projects undertaken under subsection 101 (i) shall not exceed the estimated cost set forth in that subsection by more than 10 per centum.

SEC. 103. ADVANCE PLANNING AND DESIGN.—There are hereby authorized to be appropriated funds for advance planning, construction design, and architectural services, in connection with projects which are not otherwise authorized by law, and the Atomic Energy Commission is authorized to use funds currently or otherwise available to it for such purposes.

SEC. 104. RESTORATION OR REPLACEMENT.—There are hereby authorized to be appropriated funds necessary to restore or to replace plants or facilities destroyed or otherwise seriously damaged, and the Atomic Energy Commission is authorized to use funds currently or otherwise available to it for such purposes.

SEC. 105. CURRENTLY AVAILABLE FUNDS.—In addition to the sums authorized to be appropriated to the Atomic Energy Commission by section 101 of this Act, there are hereby authorized to be appropriated to the Atomic Energy Commission to accomplish the purposes of this Act such sums of money as may be currently available to the Atomic Energy Commission.

SEC. 106. SUBSTITUTIONS.—Funds authorized to be appropriated or otherwise made available by this Act may be used to start any other new project for which an estimate was not included in this Act if it be a substitute for a project authorized in subsections 101 (a), 101 (b), or 101 (c), and the estimated cost thereof is within the limit of cost of the project for which substitution is to be made, and the Commission certifies that—

(a) the project is essential to the common defense and security; and

(b) the new project is required by changes in weapon characteristics or weapon logistic operations; and

(c) it is unable ot enter into a contract with any person, including a licensee, on terms satisfactory to the Commission to furnish from a privately owned plant or facility the product or services to be provided in the new project.

SEC. 107. PROJECT RESCISSIONS.—(a) Public Law 85–162 is amended by rescinding therefrom authorization for certain projects, except for funds heretofore obligated, as follows:

Project 58–b–1, fabrication plant, $5,000,000;

Project 58–b–3, metal treatment plant, Fernald, Ohio, $850,000; and

Project 58–e–13, Argonne boiling reactor (ARBOR), National Reactor Testing Station, Idaho, $8,500,000.

(b) Public Law 506, Eighty-fourth Congress, second session, is amended by rescinding therefrom authorization for a project, except for funds heretofore obligated, as follows:

Project 57–c–6, food irradiation facility, $3,000,000.

SEC. 108. EXPENSES FOR MOVE TO NEW PRINCIPAL OFFICE.—Public Law 85–162 is amended by striking therefrom the figure "$75,000" in section 109 a. (4) and substituting therefor the figure "$210,000".

SEC. 109. COOPERATIVE POWER REACTOR DEMONSTRATION PROGRAM.—Public Law 85–162 is amended as follows:

(a) By striking therefrom the figures "$133,863,000' and "$153,863,000" in section 111 (a) and substituting therefor the figures "$156,672,000" and "$176,672,000".

SEC. 110. GAS-COOLED POWER REACTOR.—The appropriation authorized in section 101 of this Act for project 59–d–10, gas-cooled power reactor, shall also be alternatively available for a cooperative program under which the Commission may enter into an agreement of cooperation with public, private, or cooperative power groups, equipment manufacturers or others under which the organization will design, construct, and operate the reactor at its own expense and the Commission will contribute to the cost of research and development programs necessary to the construction and research and development activities carried on during and in conjunction with the experimental operation of the reactor and will furnish such other assistance as the Commission deems appropriate, not including however any contribution of funds to be employed in the construction or operation of the reactor except under contract or other arrangements entered into pursuant to section 31 of the Atomic Energy Act of 1954, as amended.

Representative HOLIFIELD. On the same day, May 12, 1958, Senator Anderson, vice chairman of the Joint Committee, introduced, by request, identical bills in the Senate, which were identified as S. 3786, S. 3787, and S. 3788.

I would like to emphasize that all of these bills were introduced by request, and indicate the authorization legislation as submitted by the Atomic Energy Commission. As in the past, the Joint Committee will, of course, modify, add to, or delete provisions in these bills, as may be necessary, in the opinion of the Joint Committee, for the atomic energy program.

After receiving the proposed AEC bills late Friday afternoon, May 9, 1958, and acting as the chairman of the Subcommittee on Legislation, I wrote letters on the following day, May 10, 1958, to AEC Chairman Strauss and to Mr. Maurice H. Stans, Director of the Bureau of the Budget, requesting them to be present and prepared to testify during today's hearings. Without objection, I would like to insert in the record at this point copies of the letters dated May 10, 1958, from myself to Mr. Strauss and Mr. Stans.

(The letters referred to follow:)

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C., May 10, 1958.

Mr. LEWIS L. STRAUSS,
Chairman, Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: The Joint Committee received yesterday evening the letter dated May 9, 1958, from Acting Chairman Libby to Mr. Durham forwarding the proposed fiscal year 1959 authorizing legislation. Mr. Durham has informed me that, as in past years, this proposed legislation will be considered by the Subcommittee on Legislation, of which I am the chairman.

In accordance with previous arrangements, it is planned that the hearings will commence in public session next Wednesday, May 14, at 10 a. m. and 2 p. m. It is requested that you and the other Commissioners be present at these hearings. The subcommittee intends, prior to considering the proposed fiscal year 1959 legislation, to review obligations, expenditures, and actions taken on projects authorized by the Congress in prior fiscal years. Accordingly, it is requested that the Commission be prepared to testify on these subjects.

I am also requesting that the Director and appropriate representatives of the Bureau of the Budget be present at the hearing on May 14, 1958, to discuss actions taken on prior fiscal year budgets.

Sincerely yours,

CHET HOLIFIELD,
Chairman, Subcommittee on Legislation.

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C., May 10, 1958.

Mr. MAURICE H. STANS,
Director, Bureau of the Budget,
Washington, D. C.

DEAR MR. STANS: Yesterday evening the Joint Committee on Atomic Energy received from the Atomic Energy Commission a letter forwarding the proposed fiscal year 1959 authorizing legislation. The Subcommittee on Legislation, of which I am chairman, intends to commence public hearings on authorizing legislation next Wednesday, May 14, 1958, at 10 a. m. and 2 p. m. Prior to commencement of consideration of the fiscal year 1959 budget, the subcommittee intends to review actions taken on projects authorized by the Congress in prior fiscal years.

It would be appreciated if you and other appropriate representatives of the Bureau of the Budget would be present and prepared to testify on these subjects.

Sincerely yours,

CHET HOLIFIELD,
Chairman, Subcommittee on Legislation.

Representative HOLIFIELD. It is my understanding that AEC General Manager Fields will present first today a summary statement of the AEC authorizing legislation proposals. Following this, the detailed analysis of each of the projects will be inserted in the record, but detailed questioning will be postponed until next week when the

committee members and staff will have had a better opportunity to study in detail the individual projects.

It is my further understanding that AEC is preparing a more comprehensive statement of their atomic power program which will be presented toward the end of our authorization hearings when we consider the reactor development program.

Following the summary statement by General Manager Fields and the insertion of the material in the record, the subcommittee plans to undertake a review of budget holdbacks and actions taken on projects authorized by the Congress in prior year authorization acts. We are doing this in order to obtain a better perspective on this year's authorization act. It does not make sense if we authorize important projects, only to find that AEC or the Budget Bureau decide to hold them up. For this purpose the Commission has prepared certain tables and materials, and the subcommittee members may wish to question Commission representatives and representatives of the Bureau of the Budget.

We are glad to have you here this morning, Mr. Fields. Will you please proceed.

STATEMENTS OF DR. W. F. LIBBY, COMMISSIONER; K. E. FIELDS, GENERAL MANAGER; W. KENNETH DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; AND DON S. BURROWS, CONTROLLER, ATOMIC ENERGY COMMISSION

Mr. FIELDS. Mr. Chairman and members of the committee, the Atomic Energy Commission and members of its staff are appearing before you today to review the proposed authorizing legislation contemplated by section 261 of the Atomic Energy Act. We regret that we were not able to define our requests and present them for your consideration at an earlier date.

We certainly appreciate the attitude and indulgence of the committee on this point. Since the matter of an agreement has been reached as to what the request has been, we have made every effort as rapidly as we could to present these matters to you.

I believe they are all in order. There may be a few minor changes because of the speed with which we prepared this material and we may have to make some corrections.

I believe they are substantially correct and that there are no really large errors in them. We certainly appreciate the attitude of the committee with respect to this delay.

The major portion of the appropriation authority we have requested is contained in the proposed bill covering authorization of appropriations for the fiscal year 1959.

However, certain requests have also been transmitted in the form of two amendments to existing legislation. These amendments provide for situations in which it is desirable to use the requested authority before the expiration of fiscal year 1958.

The fiscal year 1959 bill proposes authorization of appropriations of $193,379,000 for new construction projects, $22,809,000 of additional authority for cooperative arrangements with industrial participants in the development of civilian power reactors, and $135,000 of addi-

tional authority to incur expenses related to the transfer of AEC headquarters to Germantown, Md.

One of the amendments submitted would increase the existing authority for two construction projects by $11,656,000. The other amendment would increase the authority now available for cooperative arrangement projects by $3,948,000.

In order to present a complete picture of this year's authorization requests, let me refer to certain requests submitted to your committee earlier in the session.

A requested amendment of Public Law 85–162 to permit undertaking a $35 million project involving construction of a destroyer reactor prototype has been recently passed by both Houses, and we are preparing to take initial steps under this authority.

Other authorization requests were submitted which do not involve additional amounts of appropriation, but only changes in language to redefine our authority to enter into certain cooperative arrangements for power reactor demonstration projects.

These proposed language changes have been revised and resubmitted in the amendment dealing with cooperative arrangements.

All of our requests for appropriation authority and for language changes will be reviewed in my opening remarks. However, some of our proposed construction projects are closely related to classified activities.

It is my understanding that the committee plans to hold an executive session for the purpose of further discussing such classified projects.

It is also my understanding that the committee plans later in these hearings to review the Commission's civilian power reactor development program in its entirety. We have prepared, at the committee's suggestion, a comprehensive statement of our civilian power program for discussion at that time.

The various civilian reactor projects and cooperative arrangements proposed in our requested legislation are, of course, integral parts of that program.

Let me now turn to a review of the proposed construction projects for which we have requested appropriation authority.

AMENDMENTS TO EXISTING CONSTRUCTION PROPECTS

Taking up the proposed amendments first, we request an increase in project 58–e–6 from $7,750,000 to $10 million. The additional $2,250,000 for Project Sherwood plant will permit getting on with construction of supporting facilities for controlled thermonuclear research at 2 of the 4 major laboratories engaged in these investigations.

The other project to be amended is 56–c–1, for which an increase from $10 million to $19,406,000 is requested. The additional $9,406,000 is required to carry out the construction of two particle accelerators, one at Cambridge, Mass., and the other at Princeton, N. J.

Substantial increases have occurred in the estimated cost of completing each of these accelerators. Work on the machine at Princeton is progressing only to the extent necessary to keep the team of scientists on the project until action is taken on this request for increased authorization.

NEW CONSTRUCTION PROJECTS

The construction projects proposed in the fiscal year 1959 bill total $193,379,000. Projects for our production programs, weapons and special nuclear materials, make up $72,135,000, or about 37 percent of the total.

Reactor development projects amount to $88,467,000, or about 46 percent of the total. General plant projects of $25,602,000 represent 13 percent, and the remaining 4 percent is principally for research and training projects.

SPECIAL NUCLEAR MATERIALS PROJECTS

For our special nuclear materials program, we are proposing four new projects, requiring $30,435,000. The largest of these is a $15 million project for necessary plant modifications and additions to provide for the processing, on a routine basis, of irradiated fuels from licensed reactors and naval reactors.

The fuels from licensed reactors are to be processed by AEC only for an interim period until industry can provide necessary capability with private capital.

The other projects in this group provide for a $335,000 pilot plant at Fernald, Ohio, for fabrication of new fuel elements; $11,900,000, in addition to last year's authorization, for fire-protection measures in gaseous diffusion plants; and $3,200,000 for new waste storage installations at the Idaho chemical processing plant.

WEAPONS PROJECTS

There are 15 new projects proposed for our atomic weapons program, at a total estimated cost of $41,700,000. We are requesting, as we have in previous years, $10 million for weapons production and development plants, of types and at locations as yet unknown. Experience has shown that such authority to expand existing plants or add additional plants is needed in order to take early advantage of advances in weapons technology.

Authorization is requested for a $3.5 million component fabrication plant at Hanford, Wash., a $12.5 million fabrication plant at Oak Ridge, Tenn., and a $2 million special processing plant at the Mound Laboratory in Ohio.

A $1.5 million project is proposed for weapon storage site modifications at various locations. Another project, for base construction at Eniwetok Proving Ground, requires $2,342,000. A $1,780,000 project for base construction at the Nevada test site is also proposed, while test area development planned for this test site will require $600,000.

At Los Alamos, N. Mex., a $2,250,000 component test facility is proposed, as is a new laboratory building requiring $590,000. Test and environmental facilities requiring $1,488,000 are proposed for the Sandia Base, N. Mex.

Three new projects at Livermore, Calif., are being proposed: a $390,000 project to provide for a lineal acceleration tester to measure the shock characteristics of weapons parts; a $2 million project for expansion of the high explosive development plant, and a $250,000 project to provide for a storage and handling building.

There is one more project in the weapons field—a $510,000 test assembly building to be built at an unspecified location.

Because of the classified nature of the special nuclear materials and atomic weapons projects I have just mentioned, my discussion of them has been necessarily brief. Any further information you may wish to have on any of these projects can be covered in executive session.

REACTOR DEVELOPMENT PROJECTS

We are proposing 11 projects for the reactor development program. The total cost of these 11 projects is $88,467,000.

For convenience, I have grouped the projects into four categories. These categories are reactors and reactor experiments, testing installations, facilities for work on the reactor fuel cycle, and controlled thermonuclear research.

The first category of reactors and reactor experiments includes four projects.

Project 59–d–10 is for the construction, at a cost of $51 million, of a prototype gas-cooled, graphite-moderated power reactor with a capacity of 40 electrical megawatts.

A design study of this reactor was authorized for fiscal year 1958, and the results were submitted to the Joint Committee. Intensive study in the past year indicates that this reactor type, using partially enriched uranium fuel, offers the potential of economic power generation.

I shall speak later of the alternative possibility of entering into cooperative arrangements with industry for a project of this general type.

The second of these projects is 59–d–8, for which we request $8 million for the construction of a heavy water component test reactor and support facilities.

Studies and development work indicate the feasibility of a heavy-water-cooled and moderated power reactor, but operating data and experience can only be obtained from a test reactor specifically designed for this purpose.

The third project, 59–d–7, is for modifications to 3 reactor experiments, at a total cost of $6.3 million. The three reactor experiments are the organic moderated reactor experiment, OMRE; the experimental boiling water reactor, EBWR; and the boiling reactor experiment, BORAX. The required modifications are a logical growth in the work already done with these reactor experiments.

Modifications to the organic moderated reactor experiment and its facilities will permit us to continue the study of organic materials for coolants and moderators at higher power levels.

The experimental boiling water reactor has successfully operated at more than three times its design capacity using light water as coolant-moderator under natural circulation.

However, further study is needed to evaluate still higher power levels and to compare plant performance with light and heavy water as the coolant-moderator and with both forced and natural circulation.

The present boiling reactor experiment facility has been used for three reactor experiments, and considerable modification of the facility is necessary before experiments on this concept can continue. The

first one blew up in ARCO during the course of the experiment, as you will recall, some years ago.

The last project in this category is 59–d–6, which covers the engineering and construction of a prototype packaged nuclear powerplant at an estimated cost of $3 million.

This plant, to have a thermal capacity of 10 megawatts, is designed to be preassembled into a minimum number of packages for rapid field erection at military bases. We are submitting three projects for reactor testing installations.

For project 59–d–3 we require $1,367,000 for a fast reactor testing station at the Nevada test site. Only minimum facilities, sufficient for complete testing of one reactor in a test operation, are provided in the project. However, the design permits future expansion when necessary.

The second testing installation is described in project 59–d–4, the Army reactor experimental area to be built at the National Reactor Testing Station in Idaho at a cost of $1 million.

Substantial savings will be possible in the development of the growing number of Army power reactors if we concentrate the technical support facilities in one central area.

The last project in this group, 59–d–2, provides for $2.3 million for a special-purpose test installation for testing of nuclear auxiliary power systems for satellites. We are proposing three projects which deal with various aspects of the reactor fueled cycle.

The first of these, project 59–d–1, calls for $3.5 million to provide an integrated fueled reprocessing plant at Oak Ridge. This plant will have two major purposes: To develop, on a pilot-plant scale, promising fueled processing techniques which have been investigated on a laboratory basis, and to carry out special processing of varying quantities of fuels containing plutonium, thorium, and uranium of various enrichments.

This project supplements 59–a–1 for which $15 million is requested and which was mentioned earlier. That project permits modifications of existing plants at Savannah River, Hanford, and Idaho, to provide for large-scale reprocessing of nonproduction spent fuels.

In project 59–d–5, we are asking for $5 million for the construction of additional hot cells urgently needed for reactor fueled development. A similar project in the amount of $3.5 million was authorized in fiscal year 1958.

Project 59–d–9 calls for $5 million to provide additions to the fuel technology center at the Argonne National Laboratory. The project will permit us to equip a new wing to the center which will be used for the development of new techniques in fabricating cores. The present facilities will be used for actual core fabriation.

The remaining project in the reactor development program concerns thermonuclear research. Project 59–d–11 calls for $2 million to provide supporting installations for the Sherwood project.

The varied nature of the experimental work conducted in this field is likely to create an urgent need for new facilities on short notice.

Money requested for this project will enable us to start the construction of such facilities, when they are needed, without the risk of delay.

Let me now comment on 3 projects we have been studying, and about which we have concluded that construction should not go forward in fiscal year 1959.

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LARGE-SCALE PRODUCTION REACTOR

Public Law 85–162 enacted last year provided for study of a large-scale single or dual-purpose reactor for production of special nuclear materials, and directed that a report on the design for this project, including cost estimates and schedule of construction, be submitted to the Joint Committee on Atomic Energy not later than April 1, 1958.

That report was submitted, and we are prepared to discuss the analysis and conclusions presented, which necessarily involve classified information. We also did provide you with an unclassified report on that project.

Since submitting the report, the Commission has continued to consider at length the matter of constructing such a reactor, and has inquired of the Department of Defense about the current military requirement for additional reactor capacity for production of special nuclear materials.

We were advised on April 16 that as of that time there was no military requirement for addition to the existing production reactor facilities. Accordingly, authorization has not been requested either for a single-purpose reactor for production of plutonium, or for a dual-purpose reactor for production of both plutonium and electric power, pending any further development on requirements. It has been the subject of hearings just these last few days, as you know.

HEAVY WATER POWER REACTOR

The Commission has had under study the construction of a heavy water power reactor. The particular merit of this type of reactor is that it could be designed to be fueled with either enriched uranium or natural uranium.

Based on research and development and design studies performed to date, it has been concluded that the reactor built would be of a more advanced design and would constitute a much more significant step toward the goal of economical nuclear power if time were allowed for additional research and development and design evaluation.

We plan to continue research and development in fiscal year 1959, and we believe that additional design studies can lead to selection of design specifications and completion of preliminary design of such a reactor in fiscal year 1959. Our budget provides $2.5 million for this purpose.

Project 59–d–8 included in the request for construction of a heavy water component test reactor at Savannah River, is in direct support of the development of a heavy water power reactor. Other steps planned for fiscal year 1959 do not require specific authorization.

LARGE TEST REACTOR

The Commission foresees a substantial need for testing reactor materials and components under the simulated operating conditions which can be provided only in the interior of a high-flux reactor.

Performance of such testing must be an integral part of the attack to be concentrated on reducing costs of the power reactor fuel cycle.

Needed space and time in test reactors can be provided by construction of additional Government-owned reactors, or by contracting for use of space in privately owned reactors.

The Commission long ago, announced its policy in this matter. We prefer to contract for space in privately owned reactors, and for this reason have not requested authorization of test reactor construction.

However, private industry is reluctant to undertake test reactors of appropriate scale without contract commitments from AEC for a substantial part of the test space for a major portion of the amortization period.

Negotiation of such arrangements depends upon clarification of the Commission's long-term contracting authority. We have proposals for admission to the committee on that. We had one before you last summer and we are amending it and will have it before you again.

INTERNATIONAL ASSISTANCE

Legislative proposals are being formulated for support of specific aspects of power reactor assistance to friendly nations and will be submitted as soon as they are fully developed.

I am particularly referring to arrangements with the Euratom group, which as you know have been receiving a great deal of attention recently.

PHYSICAL RESEARCH PROJECTS

Two projects are proposed in the field of physical research. The first one, for $500,000, provides for improvements to the bevatron, the 184-inch cyclotron, and the heavy ion linear accelerator at the University of California Radiation Laboratory at Berkeley, and for improvements to the research equipment used in conducting experiments with these accelerators.

These improvements, which are in addition to those for which authorization was requested last year, will further increase the effectiveness of these machines as research tools.

The second physical research project, also for $500,000, provides for an increase in the power level of the CP–5 research reactor at the Argonne National Laboratory from 4 to 10 thermal megawatts. The resulting higher neutron flux will enhance considerably the value of this reactor for research experiments.

BIOLOGY AND MEDICINE PROJECTS

In the field of biology and medicine, authorization is requested for a $2 million project to provide facilities to support expanded research dealing with radioactive fallout problems and the biological hazards of radiation.

Included in this project are holding areas and laboratory space for the study of dogs and larger animals, and the development and fabrication of whole body counters with heavily shielded enclosures, for use with humans and large animals. This construction is urgently required in order to place prompt additional emphasis on these studies.

TRAINING, EDUCATION, AND INFORMATION PROJECTS

Authorization is requested for three projects totaling $4.1 million in the category of training, education, and information. One of these, requiring $500,000, is a medical and biological laboratory for the regional nuclear training center in Puerto Rico.

This laboratory, which will be at a location convenient to the staff and hospital of the School of Medicine of Puerto Rico, will be used for training in the application of nuclear techniques to medicine, particularly to basic medical studies relating to cancer. Facilities for the Puerto Rican center for training and research in nuclear science and engineering were authorized last year.

The second project in this group will provide the International Atomic Energy Agency with a 1-megawatt pool-type research reactor and one or more radioisotope laboratories.

It is tentatively assumed that $1.5 million will be required for the reactor and $500,000 for the radioisotope laboratories. Facilities such as these, in the hands of the International Atomic Energy Agency, will be of great assistance in filling the worldwide requirement for more training and research in all applications of nuclear science and technology and will further the peaceful uses of atomic energy on a worldwide basis.

Since there is an immediate need for a high-level radiation source in order to scale up research and development in the field of applied radiation in the United States, the third project in this group, requiring $1.6 million, is for irradiation facilities having maximum flexibility as to source type and geometry for high-level irradiation of solids, liquids, and gases.

Developmental effort will be directed toward demonstration of the efficacy and economic potential of high-level radiation in industrial manufacturing processes.

COMMUNITY PROJECT

We have only one project for the community part of section 101 of the bill.

Project 59–h–1 is for a cinder-block building, to cost $75,000, for storage of supplies such as cafeteria food and school furniture of the Richland School District. New storage facilities will permit razing the condemned high-school building, currently used for storing school furniture, and will free storage space in the school administration building for office usage.

GENERAL PLANT PROJECTS

Section 101 (i) of the bill provides $25,602,000 for general plant projects. Included in this category are the miscellaneous minor additions, expansions, and other new construction projects required annually by our operating programs to keep abreast of technological gains and to prevent excessive deterioration and obsolescence of our facilities. The authority requested is slightly less than the amount approved a year ago.

GENERAL PROVISIONS

Let me comment only briefly on the general provisions contained in sections 102 through 106. These provisions are unchanged in substance from those enacted last year, and it is desirable that they be continued in effect.

Section 102 deals with limitations, particularly with respect to the authority to begin a project after there has been an increase in its currently estimated cost.

Section 103 continues the authority to use available funds for advanced planning of projects, construction design, and architectural review. Section 104 continues the authority to use funds to restore or replace plant facilities which have been destroyed or seriously damaged, while section 105 authorizes the reappropriation of funds already available to the Commission.

Section 106 provides limited authority to undertake substitute projects related to the special nuclear materials and weapons programs.

Before taking such action, the Commission must certify that the project is essential to the common defense and security, that the project is required by changes in weapons characteristics or weapon logistics operations, and the the Commission is unable to enter into a contract with any person, including a licensee, on terms satisfactory to the Commission, to furnish from a privately owned plant or facility the product or services to be provided in the new project.

PROJECT RESCISSIONS

Section 107 deals with project rescissions. We propose that authority for four projects be rescinded, namely, project 58–b–1 for a $5 million fabrication plant for special nuclear materials; project 58–b–3 for a $850,000 metal-treatment plant at Fernald, Ohio; project 58–e–13 for the Argonne boiling reactor, known as ARBOR and authorized at an estimated cost of $8.5 million; and project 57–c–6 for a $3 million food irradiation facility.

Authority for other projects not yet started should be continued. In many instances, projects have not been started because development work and other preparatory phases have not been completed.

In other instances, construction has been deferred on the basis of relative priority, and such deferrals are not to be interpreted as abandonment of the projects.

EMPLOYEE TRANSPORTATION SUBSIDY

Last year, in order to assure an adequate work force at the new AEC headquarters in Germantown, Md., it was found necessary to provide subsidized commuting transportation for those employees who were not served by existing transportation.

It is still considered necessary to contribute part of the cost of such transportation for at least an additional 18 months. Since we expect that last year's authorization of $75,000 for this purpose will be exhausted by June 30, 1958, section 108 of the proposed bill is an amendment to increase this authorization to $210,000, to provide the $135,000 we estimate will be needed to provide subsidized commuting transportation in fiscal year 1959.

COOPERATIVE ARRANGEMENTS

Section 109 of the fiscal year 1959 bill deals with authority for cooperative arrangements on power reactor demonstration projects.

One of the amendments we have requested also pertains to cooperative arrangements. This amendment would increase the authority for such arrangements from $129,915,000 to $133,863,000. The analysis submitted with the request shows the upward and downward adjustments made in the estimates for individual projects, resulting in a net increase of $3,948,000.

The 1959 bill proposes a further increase in cooperative arrangements authority from $133,863,000 to $156,672,000, or an increase of $22,809,000. Of this amount, $20 million is requested for proposals expected to be received for new projects, particularly second generation reactor projects.

The remaining $2,809,000 is required for preconstruction research and development on fast breeder reactors.

In addition to requesting authority for appropriation of funds for cooperative arrangements, an amendment for fiscal year 1958 is proposed to permit entering into certain arrangements which differ in slight degree from terms announced in the third round invitation.

This amendment would permit us to proceed with the project proposed by the East Central and Florida West Coast Nuclear Power Groups and phase I of the project proposed by Pennsylvania Power & Light Co. and Westinghouse Electric Corp., on the basis of program justification data now before the committee for consideration.

Also, eligibility of reactor projects for waiver of the heavy water use charge would not be limited to natural uranium reactors, but would be extended to any proposed reactor otherwise eligible for assistance under the power reactor demonstration program.

The final provision of the bill, section 110, is also related to cooperative arrangements. The largest construction project in section 101 of the bill is project 59-d-10, which authorizes Government construction of a $51 million gas-cooled power reactor.

Section 110 authorizes an alternative use of the funds appropriated for construction of this project. This section authorizes the Commission to pursue the development of this type of reactor through an appropriate cooperative arrangement with industry, which would be generally similar to those which have been submitted to the committee for third round invitation projects.

Mr. Chairman, you suggested that at this point the supporting detailed data accompanying the three bills be submitted for the record, I believe.

Representative HOLIFIELD. Without objection the detailed analysis of the items referred to in the summary and other items will be inserted in the record at this time. This came to us under date of May 9, and also the letter of transmittal to Mr. Durham signed by Dr. Libby under date of May 8.

(The letters referred to will be found on pp. 15–18. The analyses appears on pp. 69–72 and in the appendix, pp. 393–414.)

Representative HOLIFIELD. At this point before we start with our questioning on the 1958 projects which have been withheld, as chairman of the subcommittee—and I know I speak on behalf of my col-

leagues on the full committee who have received the notice of General Fields' pending resignation sometime in the near future—I want to take this opportunity to pay a sincere tribute to General Fields for the work that he has done on the Atomic Energy Commission. You have pursued your duties with initiative and industry, and your attitudes and cooperation with this committee and its staff have always been of the finest. We appreciate very much the time and the attention and the loyalty you have given to the Atomic Energy Commission program. We regret that you are going to leave the Commission. We hope the Commission will get in your place a person as good as you have been. We extend to you in whatever endeavors you may have in the future in private life our best wishes for your success and the happiness of yourself and your family.

Mr. FIELDS. Thank you very much, Mr. Chairman. I appreciate those remarks a great deal. It has been a pleasure to work with your committee. I feel the same way about the committee and the staff that you have expressed toward me. We have had our arguments, but it is an experience I will always appreciate, sir. I regret to leave. I have been in the atomic energy program for about 10 years. Maybe I will go out and get a taste of something different. I have not lost my interest in it. I am not telling you I am coming back, but I have not lost my interest in this program.

Chairman DURHAM. I want to join the chairman of the subcommittee in all he said with regard to General Fields. I have had quite a bit of experience around this Capitol in dealing with individuals appearing before the committees. I do not believe anyone ever appeared that was always as well fortified to discuss a subject as you have been since you have been with us. We will miss you.

Mr. FIELDS. Thank you, Mr. Durham.

Representative VAN ZANDT. I, too, want to join the chairman in commending the general and at the same time express my regrets that he is going to leave us. I recall when you first came to this committee in uniform, and then graduated from the military, we will say, into the AEC. You have pursued your duties with a lot of vigor and intelligence. I just want to say you will be missed and good luck to you in whatever your future may hold.

Mr. FIELDS. Thank you, sir.

Senator HICKENLOOPER. Mr. Chairman, I would like to join these tributes in appreciation to General Fields. I don't know anyone in the atomic energy activities that has brought a higher degree of intelligence, zeal, and vigor. He has had my sympathy on occasions. He has borne with the travails and difficulties mightily, I think, and with great fortitude and great intelligence. I am sincerely sorry that you feel that you want to leave this program and I join in wishing you every success in whatever line you take.

Mr. FIELDS. Thank you very much, Senator.

Representative HOLIFIELD. As noted by General Fields in his testimony, the classified projects which have been noted by line designation will be considered in executive session. There have been a series of hearings on the gas-cooled reactor which we have had with experts that will be published and available in the next few days.

At this time we want to take up for discussion a list of articles in the 1958 budget for your comment.

Representative VAN ZANDT. Mr. Chairman, may I ask two questions at this time, so we will have a continuity of the record?

Representative HOLIFIELD. Yes.

Representative VAN ZANDT. General, why is the Commission so late in presenting to the committee the authorization request for fiscal 1959?

Mr. FIELDS. Mr. Van Zandt, as you know, the Commission and the Joint Committee last fall undertook to hold conversations as well as committee hearings—I don't know whether that is the exact term—and a review of the civilian power program, to determine the objectives and the needs of the program and what should be the program of the Government in the civilian power field. This was undertaken just following last year's appropriations hearings and it was just not possible to get through those discussions and reach a determination of what the program should be by the time the regular budget was presented.

Concurrently with that, we reexamined all programs in the light of the situation at the end of the year. We considered other things as well as the civilian power program. For these reasons it has not been possible to process our authorization request any faster. It had to include amendments to our original 1959 proposal, which was processed last fall.

Representative VAN ZANDT. In other words, the Commission has done everything possible to expedite submission to the Congress of the authorization request for fiscal 1959?

Mr. FIELDS. I believe we have, sir, recognizing that there are large areas for differences of opinions, and the resolution of this did take time.

Representative VAN ZANDT. Now the second and short question. You are asking for $193 million plus for the fiscal year 1959. What did you ask for in fiscal 1958?

Mr. FIELDS. The authority in fiscal 1958 was $222,230,000 for specific construction projects, and section 111 last year included $129,915,000 for appropriations for cooperative power arrangements. So that was a total of about $352 million or thereabouts. This will be increased by $35 million if H. R. 12009 authorizing the destroyer reactor plant becomes law.

Representative VAN ZANDT. What is it this year?

Mr. FIELDS. The 1959 request is $193 million for construction plus the $23 million for the cooperative arrangements.

Representative VAN ZANDT. $352 million authorized for fiscal 1958 against $216 million requested authorization for 1959.

Mr. FIELDS. In conjunction with 1958 we are now also asking for the increase of $11,656,000, or a total of $397 million.

Representative VAN ZANDT. That will be $397 million, then?

Mr. FIELDS. Yes, sir.

Representative VAN ZANDT. I wanted to get some idea of the difference.

Chairman DURHAM. You did not get all of that in actual money last year?

Mr. FIELDS. No, sir. That was authorization. That is not appropriations.

Representative HOLIFIELD. The Chairman, Mr. Durham, sent a letter to AEC on April 24 and we received a reply to that letter on May 12,

1958, in which the AEC indicated that it was on its own initiative deferring action on four projects authorized by Congress in the 1957 Authorization Act, and those projects are identified as follows:

Projects 57–h–2 and 57–h–3 at Brookhaven.

Projects 57–h–1 at Oak Ridge and 57–h–4 at the University of California Radiation Laboratory.

(The letters referred to follow:)

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
April 24, 1958.

Mr. LEWIS L. STRAUSS,
Chairman, Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: Public Law 506, 84th Congress, the AEC Authorization Act for Fiscal Year 1957, authorized, among others, the following two projects:

Project 57–h–2, Physics Building, Brookhaven National Laboratory, $2,140,000;

Project 57–h–3, Engineering Building, Brookhaven National Laboratory, $1,879,000.

By letter dated February 4, 1957, General Manager Fields advised the Joint Committee that these projects, as well as certain others, had been deferred beyond fiscal year 1958. Since then no further report has been made. Inasmuch as the Joint Committee and the Congress have authorized these projects, it would seem improper for the Commission to defer action on them indefinitely.

As you know, very important research work is being carried out at the Brookhaven National Laboratory, involving the expenditure of many millions of dollars and construction of new physical research machines. However, the physicists who plan, carry out, and evaluate the experiments are now equipped with unsatisfactory buildings and laboratories at Brookhaven. Members and staff members of the Joint Committee on Atomic Energy have visited the Brookhaven National Laboratory within the last year and were impressed with the necessity for proceeding with these projects.

In my opinion, if the Commission does not plan to proceed with construction of these items in the near future, the Commission's authority to proceed should be rescinded in the forthcoming fiscal year 1959 authorization legislation.

It is requested that you submit a report as to contemplated action on these projects, as well as the other projects listed in the letter dated February 4, 1957, as soon as possible.

Sincerely yours,

CARL T. DURHAM, *Chairman.*

ATOMIC ENERGY COMMISSION,
Washington, D. C., May 12, 1958.

Hon. CARL T. DURHAM,
Acting Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: This is in reply to your letter of April 24, 1958, in which you request advice relative to contemplated action on several projects referred to in our letter of February 4, 1957.

In general, we have been endeavoring, in accordance with the policy which was referred to in our earlier letter and which has continued to prevail, to continually review requirements with a view toward deferring those projects of a less essential nature if such action would not impede progress in the atomic energy field.

In accordance with the policy, four of the projects have been rescheduled for initiation of construction in subsequent years. The physics building (project 57–h–2) and the engineering building (project 57–h–3) at Brookhaven National Laborotory, which are mentioned specifically in your letter, are included in this category. Also included are permanent research buildings at Oak Ridge National Laboratory, Tennessee (project 57–h–1) and engineering service building, University of California Radiation Labboratory (project 57–h–4).

The project for the reactor engineering at Argonne National Laboratory, which was included in the authorization of $25 million in the 1956 act (Public Law

141, 84th Cong.) (project 56–b–1) was rescinded in the 1958 Authorization Act (Public Law 85–162). The project for the food-irradiation facility (project 57–c–6) is being proposed for rescission in the 1959 authorization bill. This rescission is possible because the Quartermaster Corp of the Army has decided to construct a cobalt 60 irradiator in lieu of this previously authorized project.

We are continuing to hold funds for the research reactor for the Philippine Government (project 56–g–6) pending receipt of a specific proposal from that Government.

The decision relative to proceeding further with the Aircraft Nuclear Propulsion Ground Test Plant Area No. 2 project at the National Reactor Testing Station, Arco, Idaho (project 57–c–1) has been deferred until further evaluation of the research work has been accomplished.

I trust that the foregoing provides you with the information you desire.

Sincerely yours,

H. S. VANCE.

Representative HOLIFIELD. Will you comment on why those projects have been deferred indefinitely? I will address that to you, Dr. Libby.

Dr. LIBBY. I will have to ask the General Manager what the nature of these is.

Representative HOLIFIELD. These were authorized in the 1957 budget.

Mr. FIELDS. Could I make a statement on that, first?

Representative HOLIFIELD. Yes.

Dr. FIELDS. Mr. Chairman, for these projects there were authorizations and appropriations, as I recall. They were later reviewed in the light of the then existing instructions to hold expenditures to the absolute minimum essential for program execution. In the light of that, they were reviewed and it was determined that they were not immediately essential and therefore should be deferred, and they have now been deferred until after 1959.

Representative HOLIFIELD. What was the nature of these projects?

Mr. FIELDS. 57–h–1 at Oak Ridge was for a permanent research building, to replace the facilities they now have, and which are temporary facilities, as you know, in large part. It was to build a permanent addition to the laboratory at Oak Ridge.

The physics building at Brookhaven, which is project 57–h–2, again was to build a permanent physics building so that the personnel could be moved from the temporary buildings in which they have been working in since the establishment of Brookhaven.

Chairman DURHAM. Who made that decision, the Commission or the Budget Bureau?

Mr. FIELDS. Sir, we reviewed them in the light of the conditions put upon us at that time. I would have to review just how they were eliminated or deferred. I think it was because they did not fit the then current criteria as to what could go forward in that year.

Chairman DURHAM. All of these projects were primarily concerned with basic research: is that not correct, Dr. Libby?

Dr. LIBBY. Yes, sir: that was the prime function of these buildings, as I read the description. It is basic research in the laboratories. We have had difficulty in getting these buildings for years. I think the probably correct answer to the question as to who made the decision is that we reluctantly concurred in it. The Government operates as a cooperative enterprise, as you know. Faced with ceilings, the question of priority comes in. In my opinion these facilities are of pretty high priority, but other opinions differ. I think it is fair to say it was a jont conclusion, and the Commission reluctantly concurred in it.

Chairman DURHAM. I understand, of course, it has created quite a bit of concern on the part of the high-class personnel who have to work with basic research in temporary buildings.

Dr. LIBBY. Yes. The day is coming when we have to replace these buildings. They are going to fall down.

Chairman DURHAM. Are you in danger of losing any of your high-type physicists because of the lack of facilities? They do not like to work in an old barn, I know.

Dr. LIBBY. I don't know, Mr. Durham. That is a hard question to answer. I think it is safe to say it makes it more difficult to get new ones to come in. People get enamored of places and facilities, even though they be old and decrepit sometimes. Brookhaven is a very proud laboratory and a good one.

Chairman DURHAM. I think you would agree with me, Doctor, that private industry would not place top personnel in some of the buildings that we are doing research in.

Dr. LIBBY. I certainly do agree with you that these buildings should be replaced.

Representative HOLIFIELD. So this deferral of the construction was done on the recommendation of the Bureau of the Budget and reluctantly concurred in by the AEC?

Dr. LIBBY. That is my recollection.

Mr. FIELDS. Mr. Holifield, I think you could say that in the light of the criteria that were established at that time for expenditures to go forward, you would reluctantly say that they did not meet the criteria.

Representative HOLIFIELD. As I understand, this money has been appropriated. What is your attitude toward Congress rescinding the authority on this as long as you are not using it, or do you contemplate using it?

Mr. FIELDS. I think we contemplate considering again asking for appropriations for these projects at the time that the criteria are such as to permit asking for appropriations.

Representative HOLIFIELD. Is the Bureau of the Budget representative here yet?

Mr. MERRIAM. Yes, sir.

Representative HOLIFIELD. Would you please come forward?

Representative VAN ZANDT. May I ask a question first? General, when did this money become available?

Mr. FIELDS. I believe it was in the summer of 1956.

Representative VAN ZANDT. Can you be specific? Was it August, September, October——

Mr. FIELDS. It was July or August 1956, I believe, when the 1957 appropriation was passed.

Representative VAN ZANDT. When did you reluctantly agree to accept the advice that you received from the Bureau of the Budget?

Mr. FIELDS. It would have been in July or August 1956, I believe, in conjunction with the apportionment of the 1957 appropriations. I will have to check this, Mr. Van Zandt.

Representative VAN ZANDT. So the decision was made in the fall of 1956.

Mr. FIELDS. Yes, Mr. Van Zandt; I believe so.

Representative VAN ZANDT. Generally it was in the fall of 1956.

Mr. FIELDS. It was in conjunction with the apportionment of the 1957 appropriations.

Senator HICKENLOOPER. Mr. Chairman, may I ask General Fields a question?

Representative HOLIFIELD. Yes.

Senator HICKENLOOPER. In connection with the selection of these projects at Brookhaven and Oak Ridge to be kept out of the construction program, did the Budget Bureau direct you to take these specific projects out, or were you operating under a formula of expenditures and then the matter was submitted to the Commission to determine what projects could with the least difficulty be eliminated from the construction program? I am trying to find out whether the Budget Bureau moved in and said, "Cut out these four projects," or whether they said, "You folks figure out what you can get along without and meet these criteria."

Mr. FIELDS. This was in the light of the administration's desire to hold expenditures to the minimum. There were criteria established that only the most essential projects should go forward, those which were needed for the program to progress. We were given these criteria by the Bureau of the Budget, which is the agency in the Government which gives these administration positions.

These projects were reviewed in the light of these criteria. We had discussions with the Bureau looking at overall fiscal limitations, but primarily was the question of whether they fitted this new criteria. We had to agree reluctantly that they would not meet the newly stated criteria. I am not sure I answered your question sufficiently, Senator Hickenlooper. As I recall that was the main question—whether they fitted the criteria in a situation where expenditures were being attempted to be held to a minimum on new starts.

Senator HICKENLOOPER. All I am trying to get cleared up here is the question of whether or not the Bureau of the Budget went through this and picked out the four projects and said, "These don't fit the criteria," or whether you had the guidelines.

Mr. FIELDS. I am quite sure they expressed the views that they did not fit the criteria to us.

Senator HICKENLOOPER. You had the guidelines.

Mr. FIELDS. We had the guidelines also.

Senator HICKENLOOPER. And then you reluctantly had to eliminate these four projects which you and the Budget Bureau agreed did not fit the criteria.

Mr. FIELDS. That is correct, I believe.

Dr. LIBBY. May I just add a word? It is a question of what is essential, and this is a matter of opinion. As a research man, I would say these labs are more essential than some other people would say. So we have a difference from that source.

Representative HOLIFIELD. In other words, there has been a crying need for research and, in your opinion as a scientist, you considered this was very essential?

Dr. LIBBY. I thought so, yes.

Chairman DURHAM. Dr. Libby, how would you qualify these projects? Would you qualify them primarily for military use or primarily for peaceful uses?

Dr. LIBBY. Brookhaven is more for the peaceful atoms. On the other hand, Oak Ridge has a great deal of work that has immediate application to our practical programs, including the military. So I

think one would have to say that they vary all the way from the peaceful atom to the military atom in their application. They are fundamentally for research and the establishment of new knowledge.

Chairman DURHAM. It has been expressed since sputnik by the administration and everybody else that we need more basic research.

Dr. LIBBY. That is right.

Chairman DURHAM. What I am trying to get at is this, whether it is 50 percent in the peaceful uses of the atom.

Dr. LIBBY. To go back over the years and consider the work these laboratories have done and look at the practical applications that have come out of it that 50 percent might not be too bad a way to divide it, Mr. Durham.

Representative HOLIFIELD. Mr. Merriam, will you identify yourself for the reporter?

STATEMENT OF ROBERT E. MERRIAM, DEPUTY DIRECTOR; ACCOMPANIED BY WILLIAM F. SCHAUB, CHIEF, MILITARY DIVISION; FREDERICK C. SCHULDT, JR., CHIEF, ATOMIC ENERGY SECTION; AND JAMES P. BRADLEY, ACTING LEGAL ADVISER, BUREAU OF THE BUDGET

Mr. MERRIAM. Robert Merriam, Deputy Director of the Bureau of the Budget.

Representative HOLIFIELD. Mr. Merriam, I suppose as a representative of the Budget you could tell us briefly the criteria by which these projects were eliminated?

Mr. MERRIAM. You are talking about the four which are in the bill for rescission, Mr. Chairman, or the ones that are being deferred?

Representative HOLIFIELD. These items that have been authorized and appropriated for. As I understand it, the money is lying idle and has been now for 2 years. The question before the committee this morning is, Should we rescind these items which the Budget Bureau has caused to be denied?

Mr. MERRIAM. You are talking about the four that have just been discussed that are in a deferral state at the moment?

Representative HOLIFIELD. Yes.

Mr. MERRIAM. Mr. Chairman and gentlemen, I think that this entire question of deferral of projects has to be put in the broader context of budget review and the Presidential recommendations to the Congress on appropriations. These four projects were reviewed not in a vacuum, but rather in the light of, or in the context of, a review of the 1958 budget which was being prepared in the summer and the fall of 1956.

The question arose, as it does in every program, in terms of the priorities on need and uses of money in a development of those programs. As I understand it, General Fields has stated the matter very correctly. In the discussions which took place between the Bureau of the Budget and the Atomic Energy Commission, there was agreement that these projects had a lower priority than some other projects which had since emerged and which were in a status of greater need. Therefore, the Atomic Energy Commission did concur that these were of a lower priority.

As I understand it further, the money was utilized for other higher priority projects.

Representative HOLIFIELD. Is that true? Does that money remain unexpended in your funds, or have you reapportioned it?

Mr. FIELDS. The money was applied to other projects in the following fiscal year, as I recall.

Mr. BURROWS. That is correct.

Mr. FIELDS. The authorization still stands, Mr. Holifield, but the money was applied to reduce the appropriation in the following year. It would take new appropriations to institute these. The authorization is still available, and we are not requesting rescission of it. I want to be sure you understood that.

Chairman DURHAM. Did the Budget Bureau ask the Appropriations Committee to divert these funds?

Mr. MERRIAM. No, sir.

Chairman DURHAM. You got the funds?

Mr. FIELDS. When we sent forward our budget we indicated the carryovers from the previous fiscal year that are applied to reduce the total appropriation. They reduce the total appropriation but are applied in the following year.

Chairman DURHAM. Of course, you did do that.

Mr. FIELDS. We did do that; yes, sir.

Representative PRICE. Mr. Chairman, unfortunately I was detained because of other business so I am unaware of what the discussion is about. Would you mind telling me what four projects are involved?

Representative HOLIFIELD. These are the physics buildings and laboratories for research at Brookhaven, Oak Ridge, and the University of California Radiation Laboratory, authorized in 1956, and appropriated for, but withheld by order of the Bureau of the Budget or by criteria set up by the Bureau of the Budget which caused them to be reluctantly withheld by the AEC, as I understand it.

Representative PRICE. Am I correct in understanding that at least 2 of these 4 have to do with basic research?

Representative HOLIFIELD. All of them.

Representative PRICE. I think the gentleman is aware by this time that is a subject that has the lowest priority in the Bureau of the Budget. We have had testimony after testimony from the top people in our scientific program of the crying need for a stepup of basic research and the General Advisory Committee to the Atomic Energy Commission has suggested a stepup from 50 percent to 150 percent, and yet we are unable to convince the Bureau of the Budget of the importance of basic research.

Representative HOLIFIELD. The Chair is certainly aware of that.

Senator HICKENLOOPER. Mr. Chairman, may I ask a question of Dr. Libby? Has the basic research gone on in these buildings?

Dr. LIBBY. Yes.

Senator HICKENLOOPER. Is it a question of physical convenience? Have you done the same amount of basic research approximately with these existing buildings that you would do with the new buildings? In other words, you would tear down the old ones?

Dr. LIBBY. Take the physics building at Brookhaven. It is an old rickety structure. People are crowded into it.

Representative HOLIFIELD. It is a former Army barracks.

Dr. LIBBY. It is a former Army barracks of World War I. They are getting along with it, Senator, but as I said a few minutes ago, it is one of the most necessary of our laboratory buildings to be replaced and put in a modern building. However, the physicists there are working.

In the engineering building at Berkeley, I am sorry I will have to say I think this is an additional facility; is it not, General Fields?

Mr. FIELDS. It is an additional facility and would allow some rearrangement of the personnel who are spread around other parts of the laboratory.

Dr. LIBBY. The Oak Ridge situation is much like the Brookhaven. They are getting along in buildings which are inadequate and spread around the enormous campus, with a considerable impairment in efficiency.

The engineering building at Brookhaven, I believe, is also an additional facility, though again I will have to ask.

Mr. FIELDS. I think it is a replacement.

Chairman DURHAM. Dr. Libby, as I recall in California it is for radiation study. We all realize how important that has been.

Dr. LIBBY. Yes.

Representative HOSMER. Will the gentleman yield? This building would be for the purpose of taking the people who are in building 64–A adjacent to the bevatron doing this engineering service work, putting them in a separate building, and permitting the use of the building 64 for the bevatron experiment, thereby apparently increasing the efficiency of the use of that very expensive piece of machinery.

Mr. FIELDS. That is correct, Mr. Hosmer.

Representative HOLIFIELD. Is it the intent of the Commission to ask for appropriations on these existing authorizations? You haven't done it in your presented list.

Mr. FIELDS. We have not done it in 1959, sir.

Representative HOLIFIELD. Therefore, it is not before this committee for consideration.

Mr. FIELDS. No, sir, except in the considerations you are now discussing.

Representative HOLIFIELD. The rescissions.

Mr. FIELDS. We have not requested rescission.

Representative HOLIFIELD. Did you request these items in the 1959 budget?

Mr. FIELDS. We have not.

Representative HOLIFIELD. I mean from the Budget Bureau.

Mr. FIELDS. No, we did not in the 1959 budget.

Representative HOLIFIELD. We can assume, then, that you have given up on these?

Mr. FIELDS. I don't believe so, sir. It may well be that they would be requested in fiscal 1960.

Representative HOLIFIELD. The moneys appropriated for these have been applied against other projects?

Mr. FIELDS. Yes, sir. We would have to request appropriations for them in some subsequent budget. It is not requested in the 1959 budget.

Representative HOLIFIELD. Now, I call your attention to project 56–j–2, community hospital at Oak Ridge, a request for $2,900,000

which was authorized and appropriated for. As I understand it, only $130,000 has been released by the Bureau of the Budget on January of this year.

Mr. FIELDS. May Mr. Burrows answer that question?

Representative HOLIFIELD. Call your comptroller up there where he can sit and advise us.

Mr. BURROWS. Mr. Holifield, that money has been released by the Bureau of the Budget in the full amount requested.

Representative HOLIFIELD. It has been released?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. We only have the record of January 17 where $130,000 was released. Now all of it has been released?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. When?

Mr. BURROWS. The middle of April.

Representative HOLIFIELD. Let us look at project 57–c–3, modification and expansion of ANP ground test facilities, Area No. 1, Idaho, $4,300,000 requested by the AEC on January 3, and the Bureau of the Budget had refused release on January 17, 1958. What is the status of that at this time?

Mr. FIELDS. I am going to ask Mr. Burrows to answer that.

Representative HOLIFIELD. Did you identify the item, Mr. Burrows?

Mr. BURROWS. Yes, sir. We requested apportionment of that on the 3d of January. The Bureau deferred apportionment because plans for the recast of the work necessitated by the rephasing of the ANP program were not yet completed. They asked us for further information which is in the process of being supplied.

Representative HOLIFIELD. So this is 3 years old and you haven't taken any action on this as yet?

Mr. BURROWS. As I explained, Mr. Holifield, the problem is that this program has been going through some revisions which have an effect on the type of facilities which will be required.

Representative HOLIFIELD. Yes, we have had hearings on the ANP. We have had quite a number of hearings on it. We are aware of the revisions. They are mostly budgetary, aren't they? It is the result of budgetary decisions rather than technical decisions?

Mr. BURROWS. The amount we are discussing is a residual amount of a much larger amount for those facilities, most of which are already in place.

Representative HOLIFIELD. Yes. The original request was $15 million, and your planned obligations for fiscal 1958 were $7 million.

Mr. BURROWS. The balance had been obligated in prior years, sir.

Representative HOLIFIELD. So there is no action contemplated on that and you have the money available; is that right?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. That has not been apportioned against other projects.

Mr. BURROWS. No, sir.

Representative HOLIFIELD. Let us go to the next one. The next one is project 58–e–3, fuel technology center, $10 million, $9,780,000 requested on January 3, 1958, and only $700,000 was approved on January 17. I understand you have asked for an additional $5 million in this year's bill notwithstanding the fact that over 90 percent of your original authorization and appropriation is unexpended.

Mr. BURROWS. The money released on January 7, sir, was for architech-engineer work which is still proceeding. We have no reason to believe that after the design has been completed the additional money will not be released.

Representative HOLIFIELD. This is the item of $5 million which you add to the $10 million, so that the total cost now will be $15 million.

Mr. BURROWS. Yes, sir. The $5 million provides for an additional wing to this building, sir. It is an addition to the building previously authorized.

Representative HOLIFIELD. The staff tells me that the original ten was increased to twelve, so that this would make it $17 million.

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. And you expect to start work on that this year.

Mr. BURROWS. Yes, sir. We would be in a position to get bids this year. As a matter of fact, we hope to have bids in on May 16, which is just a few days from now.

Representative HOLIFIELD. Was that balance withheld because of budgetary requirements, or because of slowness in getting started in your design plans?

Mr. BURROWS. I don't know that it was a slowness in getting started. It was withheld because we were not yet in a position to obligate it.

Representative HOLIFIELD. You requested $9,780,000 on January 1958 so you hust have been ready to go on it and you were only given $700,000.

Mr. BURROWS. This is a question of timing. When we were ready to go out for bids and proceed with the final design, we asked for the entire amount of money. What the Bureau gave us was only the amount of money necessary to cover the commitments we were then engaged on. There was no implication as I understand it that the balance of the money would not be released when we were in a position to commit it.

Representative VAN ZANDT. You are satisfied there will be no delay in the construction when the engineering phase is completed?

Mr. BURROWS. Yes, sir. I have no reason to believe that this procedural action will delay the project.

Representative HOLIFIELD. Mr. Fields, who knows best as to the timing on this, the AEC or the Bureau of the Budget? Which one is equipped to exercise the best judgment on when you need this money?

Mr. FIELDS. That is a good question.

Representative HOLIFIELD. I will ask Mr. Merriam. Mr. Merriam, in these items which have been authorized and appropriated for by the Congress and for which the operating agency asks for the money on the basis of need, what is the excuse for substituting your judgment as to timing? Is it strictly from the standpoint of holding back on expenditures?

Mr. MERRIAM. No, sir.

Representative HOLIFIELD. Or does the factor of judgment as to the progress of the project enter into it?

Mr. MERRIAM. There are a number of factors, Mr. Congressman. May I put in parentheses, I have a short statement which gets into this whole procedure, and at some point if you would——

Representative HOLIFIELD. We don't want a long statement. We will accept the statement for the record. We will accept an answer for the record if you will give it to us.

Mr. MERRIAM. I will have to answer in terms of the statement because this is in the broader framework.

Representative HOLIFIELD. How many pages?

Mr. MERRIAM. It is six pages.

Representative HOLIFIELD. Six pages?

Mr. MERRIAM. Yes, double spaced.

Representative HOLIFIELD. We will call you for special testimony sometime. Can't you summarize that?

Mr. MERRIAM. I can; yes, sir.

Representative HOLIFIELD. All right.

Mr. MERRIAM. I can very quickly. I think first of all that you have to recognize the role that has been assigned to the Bureau of the Budget by the Congress.

Representative VAN ZANDT. May I interrupt to say that my thinking is to withhold Mr. Merriam for appearance later on before this committee and let him answer this specific question. I think the overall presentation you will make concerning the Bureau of the Budget may attract a lot of questions. Rather than try to put it in just a few minutes, I think we should hold you for some extensive questioning later on.

Representative HOLIFIELD. Maybe we could have you back later for a fuller answer on the question.

Mr. MERRIAM. I am, of course, at the disposition of the committee, whichever way you wish to handle it. It is difficult to answer the question out of context. The responsibilities of the Bureau of the Budget derive from enactments by the Congress in which the Director of the Bureau of the Budget is charged with assuring that money be efficiently and effectively spent. In order to answer that question in his own mind in making the apportionments, he must and feels he has the responsibility to get from the agencies detailed information as to how they are going to use the money which Congress has appropriated. This is our interpretation of what Congress had in mind.

Representative HOLIFIELD. The committee recognizes that the Bureau has a function and has a good deal of responsibility. We are aware of what that is. The question, however, I believe as posed is susceptible to an answer. You either substituted your judgment on a technical ground or upon the ground of limiting expenditures in line with your overall responsibility. This is the question that was asked, at least in inference, and I think you can say either way.

Mr. MERRIAM. I think the best answer to your question is, Mr. Chairman, that there have been a number of changes in the plans for this facility. At one time the size of the building was going to be something like 220,000 square feet. It is now being talked of in terms of about 130,000 square feet. There was a problem of an overrun which had not been justified, and for all of these reasons when the request was made in January, we asked for additional information. As has been indicated, that is being developed. This is a normal process, and I assume the fact that the agency has not yet completed its resubmission is an indication that they are in the process of firming up in their own minds the detailed plans.

Representative HOLIFIELD. We are in a high priority race with the Russians in these fields of plutonium recycling and fuel development and the ANP. These are considered to be pretty high priority projects. When the Congress approved by authorization and appropriation in this field, and the AEC is willing to go ahead, we feel that the Budget Bureau might consider some of the priority that is involved in this particular matter. I am going to go from this article to the next one.

Representative PRICE. Mr. Chairman, before you go to that, may I ask a question?

Representative HOLIFIELD. These are all in the same principle.

Representative PRICE. Yes. You would assume when the AEC went to the Budget in January asking for $9,780,000 they thought the project was ready to go forward. Does the Budget have a technical staff that is qualified to question the judgment of the Commission?

Mr. MERRIAM. The answer to that, Congressman Price, is that there are many apportionment requests which come to us which have not been firmed up; this is true both of AEC and other agencies. Naturally all other things being equal, it is understandable that the agency head would like to have the apportionment made as early as possible. This does not always mean that even in his own mind he has firmed up his plans. We don't know how we can carry out our responsibility to make sure that the money is economically and efficiently spent if we don't know what the plans are.

In addition to that, in a number of instances in which authorizations are made by the Congress—and even appropriations—they are designated in the submissions that are made to the Congress as being of a tentative nature. Even in the bill which is before your committee today, there are a number of items in which it is indicated that plans have not been firmed up.

Representative HOLIFIELD. You understand, do you not, Mr. Merriam, in the field of research and development you cannot specifically firm up a program and estimate exactly the dollars that will be needed. We are exploring new territory and new fields.

Mr. MERRIAM. I certainly do.

Representative HOLIFIELD. We have to make an estimate of judgment. These people in the AEC are experts in this field. They make an estimate to their best judgment after consultation with their engineers and scientists as to approximately what was needed. If it was ordinary construction of a brick building, then you could get within maybe 5 percent of the exact amount. But in exploring a new field of engineering and development it is impossible to firm up to the dollar or to the 5 percent area, even.

Mr. MERRIAM. There are always those problems. I think we all understand and agree with that thoroughly. However, as I indicated earlier, there are many apportionment requests which are made for understandable reasons while the plans are very much in a ferment stage. It is a little difficult to determine whether the money is going to be used in the best way possible, even recognizing, Congressman Holifield, all of the intangibles involved in this very new area. It is impossible to make any judgment as far as the Budget Director is concerned until those plans have been firmed. I don't believe in all honesty that you will find that there is any attempt, certainly with the

knowledge of the Director and myself, and I am sure our staff understands this thoroughly, to substitute the judgment of the Budget Bureau for that of the AEC in the technical matters which are involved.

Representative HOLIFIELD. Let us explore this matter and see if this is according to the record.

On project 58–e–15, which was a plutonium recycling reactor at Hanford of $15 million, I understand that the money has now finally been released. This was authorized and appropriated for fiscal 1958. Let me read from a letter of January 20, 1958, from Senator Jackson to Mr. Fields, some of the chronology of this. By letter dated September 13, 1957, Mr. H. S. Vance, as Acting Chairman of the AEC, advised the Joint Committee that design work on this project was continuing on an accelerated basis. He also advised that—

> Current planning includes the placing of procurement contracts for long lead delivery time items in October–November 1957, with ground breaking and construction estimated to begin about January 1958. It is my understanding that whereas $1 million has been released for design work to date, no money has been made available for construction despite the fact that Congress specifically appropriated money for that purpose. It is my further understanding that this holdup in funds has made impossible the placing of procurement contracts for long lead delivery time items, such as planned for October–November 1957 and which in turn may result in substantial delays in this important project.

This question was from a letter from Senator Jackson under date of January 20 to Mr. Fields.

Now I will read from a letter from Chairman Strauss to Senator Jackson under date of February 5, commenting on this item which says:

> The Bureau of the Budget also advised that in their opinion, the project could be rescoped on a smaller scale to meet the essential objectives of the project on a basis of a total estimated cost of $11 million rather than the total estimated cost of $15 million contemplated by the AEC.

It seems to me that this is a clear substitution of Budgetary judgment for AEC judgment in a field in which I doubt the Budget Bureau is competent to substitute judgment for these scientists and engineers and these Commissioners who have been working on these projects and know the elements that are involved. Yet you asked that it be rescoped on a smaller scale.

Reading further:

> It was the opinion of the AEC that the project could not be rescoped on a smaller scale without serious loss to the program objectives. A written appeal was made by Dr. Libby, Acting Chairman, to the Bureau of the Budget on January 2, 1958, stating that if the plutonium recycle test reactor were a prototype power reactor experiment, it might be possible to build a smaller and less expensive unit with only a partial sacrifice of technical objectives. Dr. Libby stated further that this facility was not a reactor experiment but a test facility and as such must incorporate features permitting the flexibility necessary to carry out an extensive and varied irradiation program necessary to demonstrate the fuel cycle.

(The letters referred to follow:)

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
January 20, 1958.

Mr. K. E. FIELDS,
General Manager, Atomic Energy Commission,
Washington, D. C.

DEAR MR. FIELDS: As you know, last year's authorization bill which became law (Public Law 85–162) contains several projects in which I and other members

of the Joint Committee are especially interested. One of these is project 58–e–15, plutonium recycle experimental reactor.

By letter dated September 13, 1957, Mr. H. S. Vance as Acting Chairman, AEC, advised the Joint Committee that design work on this project was continuing on an accelerated basis. He also advised that "current planning includes the placing of procurement contracts for long-lead delivery time items in October-November 1957 with ground breaking and construction estimated to begin about January 1958."

It is my understanding that whereas $1 million has been released for design work to date, no money has been made available for construction despite the fact that Congress specifically appropriated money for that purpose. It is my further understanding that this holdup in funds has made impossible the placing of procurement contracts for long-lead delivery time items, such as planned for October–November 1957, and which, in turn, may result in substantial delays in this important project.

In view of the known importance of the plutonium recycle experimental reactor to the national and international interests of the United States, I would like to have answers to the following questions:

1. Why has construction money for this project not been released to date?
2. Did the AEC include this project in its initial apportionment request of the Bureau of the Budget for apportionment of funds appropriated for plant acquisition and construction, and, if so, what was the date of that request?
3. Did the program division and field office, having responsibility for this project, ever submit requests as to immediate needs for funds, and, if so, what were the dates of such requests? (The Chairman of the AEC by letter dated December 12, 1957, advised the Joint Committee that program divisions and field offices had been requested to submit such requests.)
4. What action has the Commission taken—based on requests for funds from the program division or field office or based on the known need to have funds available—for placing of procurement contracts as originally planned for October and November 1957?
5. Subsequent to the initial apportionment request, has the Commission requested the Bureau of the Budget to release construction funds for this project in accordance with Bureau of the Budget requirements as set out in Mr. Strauss' letter of December 12, 1957, and, if so, what were the dates of such requests?
6. To what extent has the planned schedule of this project been affected and the expected completion date been extended by failure to release construction money when needed?

It would be appreciated if you would furnish me answers to the above questions as soon as possible but, in any event, prior to February 1.

Sincerely yours,

HENRY M. JACKSON,
United States Senator.

ATOMIC ENERGY COMMISSION,
Washington, D. C., February 5, 1958.

Hon. HENRY M. JACKSON,
Joint Committee on Atomic Energy,
Congress of the United States.

DEAR SENATOR JACKSON: Reference is made to your letter of January 20, 1958, addressed to Mr. K. E. Fields, general manager, requesting information on the status of funds requested by the Commission for the plutonium recycle reactor, project 58–e–15.

I am happy to advise you that the Bureau of the Budget has apportioned the balance of funds appropriated, in the amount of $3,930,000, on January 17, 1958, and funds have been allotted to cover the construction phase of this important project.

Information is provided on your specific questions as follows:

Question 1. Why has construction money for this project not been released to date?

Answer. Balance of money appropriated has been apportioned on January 17, 1958.

Question 2. Did the AEC include this project in its initial apportionment request of the Bureau of the Budget for apportionment of funds appropriated for plant acquisition and construction, and if so, what was the date of that request?

Answer. You will undoubtedly recall the continuance of important congressional discussions on the Commission's authorization and appropriation bills, which delayed enactment of the appropriation until August 28, 1957.

The AEC did include a request of $4,930,000 in the initial apportionment request to the Bureau of the Budget on September 11, 1957. On September 20, 1957, the Bureau of the Budget disapproved, without prejudice, the Commission's initial apportionment request, and requested that apportionment of construction funds be requested on an individual urgent project basis, pending resolution of 1959 budget levels. The $4,930,000 apportionment request represents the amount of $5 million appropriated for fiscal year 1958, less $70,000 funds advanced to the project during fiscal year 1957 for A–E work.

Question 3. Did the program division and field offices having responsibility for this project ever submit requests as to the immediate need for funds, and if so, what were the dates of such requests?

Answer. Hanford Operations Office submitted a request to the AEC Washington Program Division on September 4, 1957, requesting apportionment of funds for this project. An amount of $4,930,000 was included in the initial apportionment request to the Bureau of the Budget on September 11, 1957, and subsequently disapproved by the Bureau of the Budget as indicated in answer 2 on September 20, 1957.

Hanford Operations Office submitted revised current project data information and a request for project funding on October 15, 1957, and the responsible program division on October 25, 1957, resubmitted a request for apportionment of $4,930,000 for the project which was submitted to the Bureau of the Budget on October 30, 1957. The Bureau of the Budget apportioned $1 million on November 15, 1957, for design work only, and deferred apportionment of $3,930,000, without prejudice, pending resolution of fiscal year 1958 construction program, in context of the fiscal year 1959 budget levels. The Bureau of the Budget also advised that in their opinion, the project could be rescoped on a smaller scale to meet the essential objectives of the project, on a basis of a total estimated cost of $11 million rather than the total estimated cost of $15 million contemplated by the AEC.

The project was reviewed with the Field Office and Program Division to ascertain whether the project could be accomplished in a more economical manner without serious interference to the fuel element development objective, and was further discussed with the Bureau of the Budget representatives.

It was the opinion of the AEC that the project could not be rescoped on a smaller scale without serious loss to the program objectives. A written appeal was made by Dr. Libby, Acting Chairman, to the Bureau of the Budget on January 2, 1958, stating that if the plutonium recycle test reactor were a prototype power reactor experiment, it might be possible to build a smaller and a less expensive unit with only a partial sacrifice of technical objectives. Dr. Libby stated further that this facility was not a reactor experiment, but a test facility and as such must incorporate features permitting the flexibility necessary to carry out an extensive and varied irradiation program necessary to demonstrate the fuel cycle. The Bureau of the Budget approved the requested apportionment on January 17, 1958.

Question 4. What action has the AEC taken, based on requests for funds from the program divisions or field offices or based on known need to have funds available—for placing of procurement contracts as originally planned for October and November 1957?

Answer. As previously indicated, apportionment of funds for placing of procurement contracts was not available to the Commission until January 17, 1958. The placing of procurement contracts originally scheduled for the October and November period was rescheduled for January 1958.

Question 5. Subsequent to the initial apportionment request, has the Commission requested the Bureau of the Budget to release construction funds for this project in accordance with the Bureau of the Budget requirements, as set out in Mr. Strauss' letter of December 12, 1957, and if so, what were the dates of such requests?

Answer. The AEC has made the following requests to the Bureau of the Budget for apportionment of funds:

AEC request:	*Amount*	BOB action:	*Amount*
September 11, 1957 [1]	$4,930,000	September 20, 1957	0
October 30, 1957	4,930,000	November 15, 1957	[2] $1,000,000
January 3, 1958	3,930,000	January 17, 1958	3,930,000

[1] Initial request.
[2] Apportionment for design work only.

Question 6. To what extent has the planned schedule of this project been effected and the expected completion date been extended by failure to release construction money when needed?

Answer. There has been a delay in placement of procurement contracts as stated in answer 4. The AEC plans to let a contract on February 24, 1958, for initial ground breaking, site clearance utilities, and related preliminary work, with actual work scheduled to commence approximately March 1, 1958.

Although the previous schedule contemplated initiation of construction at an earlier date, it is believed possible that certain elements of construction can be telescoped, and we are hopeful that the originally scheduled date for beneficial occupancy can be met. We shall make every effort to that end.

I want to reassure you that every possible action will be taken to expedite completion, and to insure utilization of the important technological developments that will result from this endeavor at the earliest possible date.

Thank you for your interest and cooperation in this matter.

Sincerely yours,

LEWIS L. STRAUSS, *Chairman.*

Representative HOLIFIELD. This request, I understand, was later approved. But the point I am making is that there was a delay in it as a result of the Budget Bureau's action, and that you did substitute or tried to substitute your judgment, based on a lack of scientific information, for the judgment of the scientists and engineers.

Mr. MERRIAM. No, sir; I can't agree that is what happened here.

Representative HOLIFIELD. You can't agree?

Mr. MERRIAM. No, sir; not on the last part of the statement.

Representative HOLIFIELD. You suggested that it be rescoped on a smaller scale, did you not?

Mr. MERRIAM. That is right.

Representative HOLIFIELD. You must have had some conclusions in your mind as to why you made that suggestion.

Mr. MERRIAM. May I just review this because I think it illustrates very well the problem you have raised. This project, as you recall, was initiated in the Congress and was put into the legislation by the Congress.

Representative HOLIFIELD. That is right.

Mr. MERRIAM. It had not gone through the usual rather thorough and detailed justification process which goes into items that are in the President's budget. I mention that for this reason: Quite obviously, items which are in the budget get a great deal more detailed staff analysis in the process of preparation than those which are added. For that reason I think it is fair to say that when an apportionment request is made for an item which is in effect a new item for which I think we could agree there was a very definite directive but not the precise understanding of exactly what the details of the development were going to be, it requires some additional questions and some additional information before you can have a thorough understanding of how the money will be best used. In this particular instance we raised the question—you are absolutely correct and the record is as you have indicated—as to whether, based on our understanding of what the Congress had in mind—and we do have, Mr. Chairman, technicians who work in this area in great detail on our budgetary programs—it could be done for the $11 million. We asked the AEC to take a look at it in that light. Dr. Libby responded in the letter to which you have made reference, gave additonal facts which were not known to us at the time it was originally discussed, and indicated that the scope of the project, as they shaped it up in their minds, had been

changed and that it could not be done for the $11 million, and we accepted his judgment in that regard.

Representative HOLIFIELD. One of the reasons why your consideration of this matter may have been not complete, it seems to me in looking over your list of personnel of the Bureau of the Budget, you have as your Chief of the Military Division Mr. Schaub, and Mr. Fred Schuldt, Chief of the Atomic Energy Section of the Military Division. This was not for military purposes. This was for civilian purposes. Maybe you should have someone in there that recognizes the importance of the civilian projects, as well as the military projects.

Mr. MERRIAM. I can assure you that we looked at both aspects of the program, Mr. Holifield.

Representative HOLIFIELD. I am not reflecting on the competence of those two men.

Mr. MERRIAM. I understand. It just so happens that we divide the Government into five parts for our purposes. The military division includes the Atomic Energy Commission simply because this was a convenient way for us to divide up our work.

Representative HOLIFIELD. I certainly did not mean to reflect on the competence of these two men, but I was referring to the fact that maybe the attention given to the military items is a little bit more intense than to the civilian items.

Mr. MERRIAM. No, sir. I think that is just a matter of nomenclature.

Representative VAN ZANDT. Mr. Chairman, am I to understand that $15 million for project 58–e–15 has been approved?

Mr. MERRIAM. Yes, sir.

Representative VAN ZANDT. Instead of $11 million?

Mr. MERRIAM. Yes, sir; that is correct.

Representative VAN ZANDT. The sum of $4,930,000 has been released?

Mr. MERRIAM. Yes; that is right.

Representative HOLIFIELD. I might say to complete the record that the letter from the Chairman of the AEC says that there has been a delay in the placement of procurement contracts as stated in answer 4. The AEC plans to let a contract on February 24 for initial groundbreaking, site clearance, and related preliminary work with actual work scheduled to commence approximately March 1. I might ask at this time, has this been done?

Mr. DAVIS. Work has been started. Procurement of some of these items has actually been accomplished. I am not clear whether we have actually broken ground for construction, but it is fairly imminent in any case. I believe we have.

Representative HOLIFIELD. Has the contract been let?

Mr. DAVIS. Some contracts have been let. The contract for the initial work in construction has been let.

Representative HOSMER. I was out there about a month ago and ground clearing has started from what I saw.

Representative HOLIFIELD. The committee can understand, then, that this work is going forward.

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. How about project 56–b–2, an increase to $29 million in the 1958 act? We understand that as of December $11,850,000 has been released.

This is a project that has been hanging since 1956, as I understand it. Do you have any information to give us on that report?

Mr. BURROWS. This represents the funding of this project as provided in the 1958 appropriation. The balance of the funding is being requested in the 1959 appropriation.

Representative HOLIFIELD. That project is going forward?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. The Budget Bureau has released adequate funds for you to proceed?

Mr. BURROWS. On the first phase of the project, yes, sir.

Representative HOLIFIELD. There is no lag, then, from a lack of release of funds, no lag time?

Mr. BURROWS. I can't testify to that, sir.

Representative HOLIFIELD. Is there any other Commission representative present that can testify on that?

Mr. DAVIS. Mr. Holifield, the design work has been going on during the intervening period, and we are now in a position where we are out for bids on some of the work. The design is largely completed. I think there has been some delay in the date at which it will be completed, however.

Representative HOLIFIELD. Is that delay due to a lack of preparation on the AEC or slowness of release of funds?

Mr. DAVIS. During the time the funds were not being released, the laboratory went back and did quite a bit more thinking about the design, made some design changes. This has slowed down, a bit, the placing of the contracts. It is a rather complicated situation but the completion date has had to be delayed somewhat.

Representative HOLIFIELD. As I understand, this is the research and development work on which the PRDC large-scale reactor depends, does it not?

Mr. DAVIS. Their reactor would depend more on the development work which is going on than on the completion of the reactor itself, although some of the activities in connection with starting up that reactor will be of very great interest to PRDC.

Representative HOLIFIELD. As a matter of fact, this is all research work in the field which will be necessary for them to have before they can build their reactor and operate it.

Mr. DAVIS. Mr. Holifield, not the actual construction of EBR–2 as such.

Representative HOLIFIELD. I am not talking about the buildings now. I am talking about the reactor.

Mr. DAVIS. The work that has been done and is being done on the development of fuel elements and on the system are things which are of very great interest to PRDC. The actual construction of the reactor is not itself of too great importance to them, but then it gets back into it when they start the operation and we do these oscillator tests, such as conducted on EBR–1 and things of this sort, during the startup of EBR–2.

Representative HOLIFIELD. Can you give us an estimated date on the completion of that project?

Mr. DAVIS. I believe it is now scheduled for 1960 criticality in April. I would have to check that.

Representative HOLIFIELD. 1960?

Mr. DAVIS. Yes, sir.

Representative HOLIFIELD. Let us check on the next item, project 57–d–1, the high energy accelerator at Argonne increased from $15 million to $27 million in the 1958 act, $1,500,000 released on December 9, 1957. What is the status of that?

Mr. BURROWS. $1,500,000 represents the design money for that reactor which was the only amount appropriated for 1958, since we didn't contemplate that we would do more than design during 1958. The balance of funds will be requested in subsequent years.

Representative HOLIFIELD. Did you get the authorization for the original $15 million? I mean the appropriation, not the authorization.

Mr. BURROWS. No, sir. We only received an appropriation of $1,500,000 for design.

Representative HOLIFIELD. Do you have included in the list this year the additional money you need in this?

Mr. BURROWS. Yes, sir; we have. The $12 million which we will need in 1959 is being requested this year.

Representative HOLIFIELD. In appropriations?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. Fiscal 1958—section 111, the cooperative power reactor demonstration program, $6,500,000 release requested by AEC on February 25, 1958, and no action taken by the Bureau of the Budget as far as our records show. Can you give us a report on that?

Mr. BURROWS. Yes, sir. At that time we were trying to get apportionment on the balance of the construction funds that were held in the Bureau reserve. These amounts were for projects on which action had not yet been completed by your committee. The Bureau withheld the reserve on the ground that we were not in a position to go forward.

Representative HOLIFIELD. Are these the three projects which you recently submitted to us?

Mr. BURROWS. No, sir. These funds were for the Consumers Public Power District of Nebraska project, and were released by the Bureau of the Budget on March 6, 1958.

Representative HOLIFIELD. We will get to the ones that have been submitted in this hearing, of course. They have only been presented to us a few days ago.

Mr. BURROWS. Yes, sir.

Mr. RAMEY. I have one question in connection with the holdback last fall. There is a letter from the Commission dated December 12, 1957, from the Chairman of the Commission to the chairman of the Joint Committee that indicates that a procedure was established of holding up all projects and then requiring a monthly rejustification on the basis of specific urgent projects. This indicates that it was not so much a matter of looking over these things from a general standpoint of firming up estimates but more of an across-the-board policy of requiring specific justification. Perhaps General Fields could answer, or Mr. Merriam could answer that question.

Mr. MERRIAM. Are you addressing that to me?

Mr. RAMEY. Yes.

Mr. MERRIAM. I think the committee ought to understand that last summer we were faced with a three-pronged problem in our look at the expenditure program for the fiscal year 1958. First of all, we had the very severe inflationary problems which were then upon us. Sec-

ondly, we were bumping our heads smack up against the top of the statutory debt limitation. Third, we were under a directive—a formal directive—from at least the House of Representatives to take a relook at the 1958 budget to recommend places where budgetary reductions could be made.

Representative VAN ZANDT. What do you mean by a directive from the House of Representatives?

Mr. MERRIAM. There was a resolution which the House passed, House Resolution 190, which specifically asked the President to reexamine his 1958 budget submission to see where there could be cuts. I guess most of us have now forgotten, but we in the Budget Bureau recall very vividly that there was a very considerable discussion in Congress and elsewhere about the need for holding down on expenditures.

Representative PRICE. Mr. Chairman, may I ask a question at that point? Was your action in holding back on approval and this 10 percent cut across the board based on that resolution or was it based on your desire to hold yourself within the debt limit?

Mr. MERRIAM. It was based on a combination of those factors plus a desire not to contribute any more than necessary to the inflationary pressures which were particularly strong in the construction area.

Representative PRICE. What was the main concern at that time?

Mr. MERRIAM. I would have to say that the primary concern was the debt limit, because this was a statutory enactment. The resolution was an expression of the opinion of the House and was not of a statutory nature. But the debt limit was. Actually in December of this last year at one time we were within $200 million of the ceiling, and that means that if there had been a snowstorm in December of the February and March varieties and the receipts had not come in for 2 days, the Treasury would not have had sufficient money.

Representative PRICE. I think you are correct. I think you have finally given us the correct answer. The primary concern was exceeding the debt limit.

Mr. MERRIAM. I would say primarily because that was a statutory responsibility.

Representative VAN ZANDT. Mr. Merriam, I understand you gave three reasons. Would you go into some detail about them?

Mr. MERRIAM. Yes, sir. As you recall, I am sure, we were having a very heavily inflationary pressure in a number of areas and particularly in the construction area in which we found costs were beginning to rise because we were competing not only with ourselves, but with what was then a very heavy expansion in private industrial construction and State and local government activities. It was the President's hope and desire that through a limitation of Government expenditures, through the deferral of some of the construction activities which we had in mind, we could reduce those pressures.

Representative VAN ZANDT. What you are saying here is that the price-of-living index was going up and the dollar was being devalued, is that it?

Mr. MERRIAM. Yes; that is right.

Representative VAN ZANDT. The second was the debt limit.

Mr. MERRIAM. Yes, sir.

Representative VAN ZANDT. Did the administration make a request of the Congress to up the ceiling?

Mr. MERRIAM. No; there was not a formal request. Secretary Anderson in one of his first acts when he took office wrote the chairmen of the pertinent congressional committees to point out this situation to them. A number of informal conversations were held, and it was made clear to him that even if the administration asked for an increase, it would not be granted.

On the basis of that it was decided to try to bump along until the next session.

Representative VAN ZANDT. I think I recall several statements that were made by Members of Congress that to the effect there would be no amendments reported out of certain committees upping the debt ceiling as far as they were concerned.

The resolution which you speak of, House Resolution 190, what did it provide for in the way of a reduction of spending?

Mr. MERRIAM. Congressman, it merely requested—actually it is a one-sentence resolution:

> Whereas the House of Representatives must in the public interest make substantial reductions in the President's budget for the fiscal year 1958, be it hereby resolved, that the President respectfully be requested to indicate the places and amounts in his budget where he thinks substantial reductions may best be made, and be it further resolved, that a copy of this resolution be transmitted to the President.

Representative VAN ZANDT. All three of these points, then, were taken into consideration.

Mr. MERRIAM. Yes.

Representative VAN ZANDT. And you adopted a policy.

Mr. MERRIAM. As a result of all of that on June 28 of last year the Budget Director sent a letter to each agency head asking him, to the extent feasible, to hold 1958 expenditures to the 1957 level. It was in this context that there was a review of this program before you today as well as every other agency's program. We had the additional fact that we were beginning to develop the 1959 budgetary requests, and it seemed only logical and commonsense that the 1958 program, and particularly the construction program, be considered in the light of what we were going to ask for 1959. In other words, to use a specific example, if we were not going to ask for additional funds for project X in 1959, a real question could be raised, we felt, as to how fast you are going ahead with it in 1958.

Representative VAN ZANDT. Mr. Merriam, before another committee of the House, Assistant Secretary of Defense Quarles made a statement where he said that instead of spending a certain amount of money for a quarter of the fiscal year, to the extent of one-half of the budget allowance, they only spent one-sixth as a result of this policy of the Bureau of the Budget. Would you say that statement was correct?

Mr. MERRIAM. I couldn't give you an exact answer without taking a look at the figures, but there is no doubt that in all of the agencies expenditures proceeded at a rate slower than the theoretical maximum authorized by the appropriations.

Representative VAN ZANDT. This applied to national defense?

Mr. MERRIAM. Yes, sir.

Representative VAN ZANDT. I think he said up until that particular time, mentioning the date, they should have spent one-half of the

amount of money appropriated for defense, but had only spent one-sixth as a result of this policy.

Mr. MERRIAM. That seems a little stiff, Congressman, but the premise I certainly would accept.

Mr. SCHAUB. It is true that initially the funds released for obligation in the first 6 months were about one-sixth of what they planned for the year.

Representative VAN ZANDT. Mr. Schaub, can you translate that into dollars? I think Mr. Quarles mentioned something around $2 billion.

Mr. MERRIAM. What Mr. Schaub is trying to say is that the rate of obligation did go down. The rate of expenditures, the actual outlay of cash, actually was still going up.

Representative PRICE. Mr. Merriam, will you give us the date of the House resolution?

Mr. MERRIAM. March 11.

Representative PRICE. That is the resolution that the House adopted in the race last year between the executive and the legislative branches to see which could reduce the mostest the fastest. The purpose of that resolution was to have a report back from the Executive before Congress adjourned so that adjustments could be made in the recommendations for expenditures which were then before the Congress. I can't see how the Budget could interpet that to have anything at all to do with the action that took place in the fall of the year, because the Congress had already worked its will on the recommendations from the executive branch on the various appropriation bills. I don't see how you could interpret that resolution to have a thing to do with the problem that we are talking about now.

Mr. MERRIAM. I merely cited that as one of many examples of expressions of intent, as we interpreted them, on the part of the Congress to limit expenditures.

Representative PRICE. That is the point. I do not see how you could interpret that to have anything at all to do with this because that was a resolution that the Congress passed challenging the executive to make the recommendations that some Cabinet members stated unofficially indicating cuts in the Budget could be made. However, in appearances before congressional committees they said they couldn't be made. The gentleman is well aware of that battle.

Mr. MERRIAM. I think you are thinking of the year before.

Representative PRICE. No, I am thinking of last year. I am definitely thinking of last year. I am thinking of the time when the resolution was adopted.

Mr. MERRIAM. I don't recall any statements by the executive branch.

Representative PRICE. All I have to do is to refer the gentleman's attention to the newspaper files at the time. I think they will bear me out.

Representative HOLIFIELD. The date of the resolution was before the appropriations. It has no application to the appropriations because we had no advice on the appropriations. We went ahead with the appropriations for lack of advice from the executive department. We were considering the executive department's requests for appropriations.

Representative PRICE. We had recommendations from the Bureau of the Budget and from the administration on the needs of the Government for the fiscal year 1958, and after these recommendations came to the Congress various Cabinet members then started to say that there was room for reduction. But when they appeared before congressional committees they could not point out the specific places where reductions could be made. So Congress then requested the executive to point those places out. But that was done entirely before action was completed in the Congress on fiscal matters. What we are talking about now is what happened after the Congress and the executive were in agreement, and the President had approved the appropriations bills that the Congress passed. That is the situation we are talking about here.

Mr. MERRIAM. May I say on that score, Congressman, that I think all of us have to remember that an appropriation is merely an authority to spend money and is a ceiling.

Representative PRICE. I don't disagree with that at all, but I think you were in error in bringing up House Resolution 190. I don't think it proves the point you sought to prove by using it.

Mr. MERRIAM. I merely cite it as an expression of congressional intent to hold down on expenditures, and there were many others, including a statement by the chairman of the Senate Finance Committee after the appropriations had been made, warning the President that expenditures should be held down.

Representative PRICE. The congressional intent here was to have the people within the executive branch, who in speeches stated that cuts could be made in the budget that had been sent up, and yet in appearance before congressional commitees could not pinpoint the places where they could be made.

Mr. MERRIAM. There were no such——

Representative PRICE. The intent of Congress here was to get somebody with responsibility and authority in the executive to pinpoint those places before Congress completed its action on the various appropriation bills.

Mr. MERRIAM. I recall no such statements at all, Congressman Price.

Representative PRICE. I would suggest that the gentleman spend the noon hour in the reference section of the Library of Congress.

Representative VAN ZANDT. Mr. Chairman, I recall the debate on House Resolution 190, and the fact specific figures were used by certain Members of the House as to the amount of money that should be cut. In one instance $10 billion was mentioned. Mr. Merriam, is not it true that when interpreting the intent of House Resolution 190, you read the debate on the floor of the House?

Mr. MERRIAM. I did very carefully.

Representative VAN ZANDT. And it had something to do with formulating policy.

Mr. MERRIAM. Yes, sir.

Representative VAN ZANDT. That is right.

Representative PRICE. I would have to disagree with the gentleman.

Representative HOLIFIELD. The position of the House was taken in the amounts of appropriations which were passed and not on the state-

ment of any one individual or any two individuals, but the position the House took on the appropriations is indicated by majority votes.

Representative PRICE. I think you only have to read the resolution and the intent is clear in the resolution itself.

Representative HOLIFIELD. The Chair would like to adjourn the meeting at 12:15 if we can, but there is one point I wish to cover.

Representative VAN ZANDT. May I make one more observation before getting off this subject? The gentleman from Illinois put his finger on the spot when he said there was a race between the Congress and the administration for economy, and House Resolution 190 was designed to put the majority party in Congress on the record in favor of economy. The vote was strictly on party line basis. That is all, Mr. Chairman.

Representative HOLIFIELD. Mr. Merriam, we have before us the item submitted by the AEC for budget consideration, a total of $150,400,000 that was denied by the Budget. The Department of Defense small plant reactors, $30 million; tanker propulsion plant, $7 million; heavy water power rector, $65 million; materials and engineering test reactors, $35 million; Argonne boiling reactor, known as the Arbor project, $5 million; metals and processing development plant at Ames, Iowa, $1,900,000; metal and ceramics research building, Oak Ridge National Laboratory, $6,500,000; and plutonium reactor which had been requested by the committee, but was not submitted, as I understand. That is the plutonium production reactor and not the recycle reactor that I speak of.

I ask you, Mr. Merriam, were those items eliminated by the Bureau of the Budget on the basis of budgetary limitation or upon the basis of your technical judgment as to whether they were needed or not?

Mr. MERRIAM. Mr. Chairman, all of these items were included in the initial supplemental request submitted by the AEC to us. I am told by Mr. Schuldt, that Arbor was in the formal submission as an increase in a prior authorization. With the exception of Arbor, all these items were new projects in the supplemental request.

Representative HOLIFIELD. We have in the AEC submission on page 2, I guess, Arbor reactor, $5 million.

Mr. FIELDS. Mr. Holifield, technically speaking, Arbor was in our amendment as an increase to a prior authorization. It was originally in our 1958 authorization act. In a subsequent review we determined that this project should be canceled. It is being offered for rescission in section 107 of our proposed bill for 1959.

Representative HOLIFIELD. This was canceled by the AEC after formal submission to the Bureau?

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. The Argonne boiling reactor, $5 million. Now will you respond to my question on the other items, please?

Mr. MERRIAM. Yes, sir. As I say, with the exception of Arbor, these items were submitted in the initial submission of the AEC to us for a supplemental estimate. Mr. Chairman, on the supplemental requests we, of course, have to look at them in the light of the general situation before making supplemental requests to the Congress. By and large the criterion is that there be some significant change in conditions since the fall, when the budget was developed, and January, when the President submitted it, to warrant a supplemental request.

Otherwise the Congress could, as it has on occasion, logically ask why these matters were not considered at the time the budget was submitted. I mention that by way of preface to indicate that there is a harder look at supplemental requests than there would be at regular budgetary items.

Representative HOLIFIELD. The AEC testified before us that the submission of a later request would not prejudice the items involved because of the difference in time.

Mr. MERRIAM. I am not sure I follow you.

Representative HOLIFIELD. In the discussions, I can't recall whether formal or informal, the AEC did tell us that the submission of this supplemental group of items would not be prejudiced because of later submission. They would be received and given the same consideration as the original basic budget.

Mr. MERRIAM. I think that is correct. My point was that you have to evaluate supplemental requests in the light of what change in conditions has taken place, as one factor, which warrant a supplemental submission to the Congress. In the case of this particular supplemental request there were innumerable discussions with the AEC on the whole problem during the course of which these particular items by common consent were eliminated from the request.

Representative HOLIFIELD. By common consent of the Budget Bureau and the AEC?

Mr. MERRIAM. Yes, sir.

Representative HOLIFIELD. Does the record stand that the Commission agreed that these items be cut out?

Mr. FIELDS. Mr. Chairman, I suppose it somewhat depends on your definition of "consent."

Representative HOLIFIELD. We assume that all the members of the Commission have passed the age of consent.

Mr. FIELDS. Could I go through the list and tell you what I understand happened in the review of these projects?

Representative HOLIFIELD. Yes.

Mr. FIELDS. As Mr. Merriam said we had several conferences with respect to our amendment to the 1959 budget. We did request these projects. In the case of the first two, which are the Department of Defense small plant reactors and the tanker propulsion plants, in discussions with the Bureau it was evident that they felt they were close to being applications in actual construction projects and fell on the borderline of the understanding between the Department of Defense and ourselves that we do the reactor development and they fund actual operating reactors. Similarly with the Maritime Commission project, and since they were applications they should be funded by the agencies by which they were required. We consented to that.

Mr. RAMEY. You lose a year?

Mr. FIELDS. I am not sure. I think the Maritime Administration is now discussing, with the Bureau, the question of application of funds for the construction of this reactor from money which they presently have. It is under consideration there.

In the case of the heavy water power reactor the situation when we discussed this with the Bureau was as I commented in my statement. We were at this stage and time in the project and we had been considering what our future course should be for sometime. It is clear

that to come forward with the most effective reactor, research and development should go on for another 8 or 9 months, and that we would be doing only preliminary engineering design in fiscal 1959.

With good luck we might be in a position to start construction right near the end of that year. It was so close to the borderline and it was their feeling that authorization of this project should be deferred until fiscal 1960. In the face of that, with authority to do the development and the design work, and the inclusion of the $8 million component test facility which is essential to further development, we consented to deferring authorization of that for another fiscal year.

We had requested $35 million which would be used by the Government to build two engineering test reactors in the event that we were unable to get contracts with commercial concerns during this period of time for the provision of the services that were required and represented by these two test reactors. In the discussions and further looking at it, we agreed that perhaps we should for a year, rely on the contracting authority we are requesting and see if we can't during that time get contracts with commercial concerns for this reactor service.

Representative HOLIFIELD. We won't go into the details, but you well know—I am not criticizing what you said today—the problem that is involved in privately owned test reactors.

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. This has been before the committee. There are privately owned test reactors at this time which the industry will not use because of trade-secret revealment. We know that the Government-owned test reactors are overburdened with work right now. We know that this is a real bottleneck in the testing of materials and other types of engineering tests.

It would seem to me that this item here would be one of the last that the AEC give consent to having cut out of the budget. I recognize the fact that you are powerless if the Budget Bureau cuts it out, but it seems to me that this is one point where you should have stood firm.

Mr. FIELDS. Mr. Chairman, as you say we will get to this in detail later on. I am not convinced that the limitation you first indicated bears on all of the test reactors being considered by industry, namely, that there is a limitation because the possibility of trade secrets being given away. I am sure you will wish to go into that more fully at a subsequent time.

Representative HOLIFIELD. I will.

Mr. FIELDS. With respect to the ARBOR, we are farther along in time and in the programing of it. In relooking at the budget and all of our resources, we decided that because of the very favorable and good results obtained from the boiling water reactor at Argonne, from the Vallecitos reactor, and all the work that is going on in the boiling water reactor field, this project should be abandoned.

With respect to the metals process development plant at Ames and the metals and ceramics research building at Oak Ridge National Laboratory, these are projects that we would like to go forward with. There are a number of factors as to why they are not included here, including the question whether or not they are essential, completely,

for the progress of the program, and suitable for supplemental submissions.

This is on the borderline that these should be in a regular budget rather than in an amendment. There were a number of discussions and in agreeing on the overall amounts we in effect withdrew them. I believe that is the story of how that happened and that is the reason for my reference to a definition of consent.

Representative HOLIFIELD. We will go into more detail on that matter in another meeting. At this time I want to ask you a question, General Fields. When you had imposed upon you by the Budget Bureau the necessity for resubmission—frequent resubmission—did you find that this resubmission process was a handicap to you in your dealing with the contractors? I understand it was almost on a monthly basis, was it not?

Mr. FIELDS. I think one has to make a distinction here between operating and plant money. In the case of the operating funds we operated more or less at the previous year's fiscal levels. There was an uncertainty as to where there were increases to be allowed under temporary appropriations, and at what point you could do this.

This probably resulted in some slippages on occasions. It was a hindrance to knowing what your full plan for the year was. Mr. Chairman, I cannot say that this resulted in significant delays anywhere in the program on the operating side.

Representative HOLIFIELD. But in the construction side it did.

Mr. FIELDS. In the construction side there was the short delay on the procurement on the plutonium recycle reactor and a few instances of that nature.

Representative HOLIFIELD. Are you still under those regulations?

Mr. FIELDS. I don't believe so at this time. The money has been released and we can make use of it at this time.

Representative HOLIFIELD. Can we give credit to sputnik for that or the Budget Bureau?

Mr. FIELDS. I don't know, sir.

Representative PRICE. As you express your concern for the delays of many of the projects as a result of the holdup of funds, I want to express my concern in the holdup of funds on projects that have to do with basic research. We have had extensive hearings on this subject where our own people within our own program—the top people—complained about holdup of funds interfering with their work.

These are the people in the field who are actually doing the work. They have almost unanimously described holdup of funds that should have been available in 1957 and 1958. They used strong terms. They referred to such holdups as being disastrous to the basic research program. They feel—this is by actual contact with them, it is not second guessing—that we are finished in our competition with the Russians if we don't have a substantial increase in funds for basic research in the 1959 budget, and that means that these funds must be turned loose promptly so that they can go about their work on a continuous basis and not have these periods of delay and frustration where they don't know where they are going.

Representative HOLIFIELD. The next meeting will have to be on Monday. We will not be able to have a meeting this afternoon because the Mutual Security Act is on the floor under amendment proce-

dure. So the meeting will adjourn until Monday. Mr. Merriam, we will accept your full statement, for the record, at this point, and also include correspondence between the Joint Committee, the AEC, and the Department of Defense on budgetary holdbacks.

(The statement and correspondence referred to follow:)

STATEMENT OF ROBERT E. MERRIAM, DEPUTY DIRECTOR OF THE BUREAU OF THE BUDGET, ON APPORTIONMENT OF CONSTRUCTION FUNDS FOR THE ATOMIC ENERGY COMMISSION

Mr. Chairman and members of the committee, I am pleased to appear before you to discuss the actions of the Bureau of the Budget in apportionment of funds for Atomic Energy Commission construction projects authorized and appropriated for prior to the fiscal year 1959.

The procedures for apportioning funds for AEC construction projects rest upon legislation which applies to Federal agencies generally. A brief outline of these general procedures is essential as a background for considering these specific problems. The apportionment process is required by the Antideficiency Act (31 U. S. C. 665). This statute is derived from an act of 1870 which has been reaffirmed and revised by the Congress several times since that date. The last substantial revision of the act was in 1951, and reflects the desire of Congress, as expressed in the House Appropriations Committee report on the bill which contained this revision, "to require careful apportionment of all types of funds expended by Federal agencies and efficient administration of the Government's business."

The apportionment system was designed by the Congress to achieve the most effective and economical use of funds made available by Congress, and, for appropriations available for a definite period of time, to prevent the necessity for supplemental or deficiency appropriations. The apportionments by the Bureau, therefore, set forth the maximum amount of obligations which may be incurred under the various appropriations.

The apportionment process is only one step in the entire budgetary cycle, which starts many months before funds are appropriated. Agencies discuss their programs and plans in general terms with us more than a year before the start of a given budget year. In the ensuing months general budgetary guidelines or objectives are established with the agencies. In this context the agency prepares its budget proposals for submission to the Bureau of the Budget in the fall of the year preceding the next fiscal year. As you know, in January, after weighing competing budgetary demands, probable available revenues, economic conditions, the international situation, and other relevant factors, the President transmits his budget recommendations to the Congress.

After appropriations become available, agency plans for each fiscal year are brought up to date. The revised plans take account of the changes resulting from congressional action, other changes in the amounts expected to become available, and program changes.

Under normal conditions, and if the programs transmitted to Congress have not changed materially, Bureau review of apportionment requests may be routine. However, if by the time appropriations are available, the previously estimated rate of obligations has lagged, production and development schedules have slipped, more economical and efficient ways to carry on the program have been developed, or other developments of a technical nature have occurred, it would be expected that requirements for funds would be adjusted accordingly.

Under the statute, reserves may be established "to provide for contingencies, or to effect savings whenever savings are made possible by or through changes in requirements, greater efficiency of operations, or other developments subsequent to the date on which such appropriation was made available." Amounts held in reserve may not be obligated by the agency until released in whole or in part by further apportionment action at any time during the year.

There are often cases where the Director is not furnished sufficient information to enable him to determine whether the apportionment proposed by the agencies will achieve the most effective and economical use of the appropriation. Under these circumstances full apportionment of funds would necessarily await the firming up of the programs.

More specifically, in the case of AEC there are special reasons for careful apportionment review of construction projects.

First, there is the rapidly changing and developmental nature of many AEC programs. Projects which loom importantly in AEC plans at one time recede in priority or are even dropped as time passes. (For example, in the pending authorization bill four previously authorized projects are proposed for rescission.) Funds appropriated for projects which do not go forward are available for cost overruns or acceleration in other authorized projects. In such a complex and changing program, where it is difficult to forecast the pace of development, the apportionment procedure is essential to insure that funds are used effectively and economically.

Second, a number of projects presented in the budget are necessarily of a contingency nature which generally cover probable urgent construction needs, which at the time of budget preparation are not sufficiently specified to permit the kind of detailed planning and review normally given prior to submission of the budget estimates to the Congress. The contingency nature of these projects is made clear in the justification material sent to the Congress. Examples of such projects are weapons production and development plant; improvements to production and supporting installations, Hanford, Wash., and Savannah River, S. C.; power reactor development acceleration project; and Project Sherwood plant. Other projects may be specified as to general nature and location, but costs and physical features of the project sometimes cannot be determined until detailed design, and often supporting development, has gone forward.

In summary, the procedures I have outlined are a result of the unavoidable length of the budget cycle and the fast-moving and changing nature of the AEC program.

Turning to the situation in the fiscal year 1958, it was contemplated that the apportionment and allotment system would additionally be used as an administrative channel to carry out the President's instructions on budget policies for that fiscal year. These policies contemplated that where possible some proposed expenditures would be deferred. By June of 1957 it became apparent that we were facing expenditures which could well exceed the amounts permitted by the statutory debt limit. The Secretary of the Treasury and other responsible officials were greatly concerned about this situation. Also, at that time there were very heavy inflationary pressures, and the executive branch was under considerable pressure from the Congress to reduce the size of Government expenditures. In fact, as you know, the House of Representatives by formal resolution (H. Res. 190) requested the President last spring to reanalyze and revise his budget submission. It was within this context that the President's instructions referred to above were issued to the departments and agencies.

These same considerations applied to our preliminary planning for the 1959 budget. In this context, it was considered by the then Director of the Bureau of the Budget that it was essential to reevaluate the 1958 construction program in order to develop a coordinated program which would insure the most effective use of funds for both fiscal years 1958 and 1959. It was his judgment that this procedure would permit emphasis to be given to the most urgent requirements that could be accomplished within funds expected to be available. Therefore, on September 20, we notified the Commission that the apportionment of construction funds was deferred without prejudice pending clarification of the 1958 construction program in relation to forthcoming 1959 decisions. Thus for a period of approximately 2½ months we apportioned funds on a project-by-project basis for urgently needed projects only. The balance of the appropriation was temporarily placed in reserve.

Since last fall conditions have changed; the debt limit has been raised, the economic outlook has changed, a 1959 budget proposing sizable increases in AEC expenditure levels has been transmitted, and more recently a 1959 budget amendment to accelerate the weapons reactor development, and basic research programs is now being processed. These developments have been reflected in revised 1958 apportionments, which have made available to AEC substantially all of the funds which the Commission has requested.

Of necessity, this is a brief summary of a very complex part of the budgetary process. Our responsibility as a staff agency for the President is to assist him in his responsibilities to expend in an efficient and economical manner the appropriations enacted by Congress. I will be glad to answer any questions which you may have, and I am sure that the AEC will be glad to provide you with greater detail.

JOINT COMMITTEE ON ATOMIC ENERGY,
November 7, 1957.

Hon. LEWIS L. STRAUSS,
Chairman, United States Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: In order to discharge its responsibilities to the Congress and to the public effectively, the joint committee must have a continuing flow of current information on the disposition of funds authorized and appropriated by the Congress for the atomic energy program. In particular, the joint committee needs current information on the following:

1. Construction projects which are being deferred because the Bureau of the Budget is withholding plant construction and acquisition funds, and amount of funds being withheld.
2. Programs and subprograms which are being deferred because the Bureau of the Budget is withholding operating funds, and amount of funds being withheld.
3. Instances where the Commission has not requested appropriated funds to be apportioned by the Bureau of the Budget, and the amount of these funds.
4. Instances where funds have been apportioned by the Bureau of the Budget but are being withheld by the Commission, the reasons for withholding these funds, and the amount of such funds in each instance.

It is requested that the Commission provide the above information to the committee as soon as possible, and that the Commission submit this information to the committee hereafter on a quarterly basis. It is assumed that if any significant changes occur in the Commission's construction or operating program within any given quarter, the Commission will inform the committee of these changes.

Your cooperation in providing the committee with the above information is appreciated.

Sincerely yours,

CARL T. DURHAM, *Chairman.*

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., December 12, 1957.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: In accordance with the request contained in your letter of November 7, 1957, there is submitted information on the disposition of funds appropriated by the Congress for the atomic energy program. The information is based on the disposition of funds available to the Commission for the fiscal year 1958 as of November 30, 1957.

The Commission, within 15 days after enactment of the 1958 appropriation on August 27, 1957, requested the apportionment of all funds available for operating expenses with the exception of $13 million which was offered as a budgetary reserve. This reserve represented savings resulting from revisions in the manned aircraft reactor development program. The Commission had been operating under the provisions of the temporary resolution until September 26. The Bureau of the Budget, pending a determination of amounts to be included in the fiscal year 1959 budget, and the effect thereof on the 1958 program in line with the President's effort to hold down expenditures wherever possible, has apportioned funds for the weapons program for the full fiscal year and for all other programs for only the first 6 months of the fiscal year. In making the interim apportionment for 6 months, the Bureau of the Budget advised the Commission that "* * * this action contemplated maintenance of activity at or below present program levels except in certain cases which required special consideration," in the context of the Director's letter of June 28 to all agencies setting forth the President's 1958 budget policy.

In discussions with the Bureau of the Budget staff, it was agreed that planned increases in the raw materials, special nuclear materials, and the weapons programs were necessary and that the Commission would proceed within the limits of the programs approved by the Congress. Exceptions also have been made to provide for increases in the controlled thermonuclear program, in research related to the fallout program and to undertake the studies on the production reactor for special nuclear materials and the natural uranium, gas-cooled power reactor as authorized by the Congress. The Commission also included in the

initial apportionment request the apportionment of all funds appropriated for plant acquisition and construction. However, the Bureau of the Budget informed the Commission that pending resolution of the 1959 budget level, they would apportion funds for plant acquisition and construction only on the basis of requests for specific urgent projects. The program divisions and field offices have been instructed to submit requests for such projects for which there is an immediate need for funds.

Specific information related to subparagraphs of your letter is as follows:

(1) The attached table lists those projects for which apportionment had been requested of the Bureau of the Budget but on which no action had been taken as of November 30, 1957.

(2) By reason of the 6 months' apportionment of operating expense funds by the Bureau of the Budget, as set forth above, it has not been necessary to defer any programs or subprograms.

(3) The Commission, as of November 30, had resubmitted apportionment requests for construction funds for projects of an urgent nature and has continued to submit apportionment requests as projects have become urgent. The unapportioned funds which had not been requested on a project basis as of November 30 amounted to $321.2 million.

(4) Of the funds apportioned for construction projects in the amount of $95 million the Commission had not allotted $1.7 million. This balance represents an adjustment in the cost of the approved projects. Relative to the apportionment of $1,098.5 million for operations, $62.3 million had not been allotted since these funds represented the amount in excess of requirements for 6 months and were, therefore, available to meet emergencies.

The Commission would propose to submit the next report on the status of the distribution of funds as of December 31, 1957, and quarterly thereafter.

Sincerely yours,

LEWIS STRAUSS, *Chairman.*

U. S. Atomic Energy Commission—Plant acquisition and construction—Apportionment requests awaiting approval by the Bureau of the Budget as of Nov. 30, 1957

[In thousands]

	Apportionment requested	
	Date	Amount
Weapons:		
58-c-1. Weapons production and development plant	Nov. 29, 1957	$1,6542
58-d-4. Engineering and Laboratory Building, Los Alamos, N. Mex	Nov. 22, 1957	772
57-b-2. Weapons assembly plants	Nov. 29, 1957	19
57-f-1. Metallurgy Laboratory, Livermore, Calif	do	2,270
57-f-3. HE and weaponizing plant, Livermore, Calif	Nov. 22, 1957	689
Reactor development:		
58-e-4. Modifications and additions, ANP area No. 1	do	373
58-e-7. Waste calcination system	Nov. 29, 1957	3,848
58-e-8. Hot cells	Nov. 19, 1957	2,400
	Nov. 29, 1957	1,100
58-f-3. Land acquisition	Nov. 27, 1957	1,000
57-c-7. Project Sherwood plant	Nov. 14, 1957	401
57-c-9. MHR hot cell extension	Nov. 29, 1957	310
Merchant ship reactor	Nov. 20, 1957	7,978
Physical research:		
57-d-1. High energy accelerator, ANL	Nov. 14, 1957	1,500
57-h-5. Cosmotron target area, ANL	Nov. 29, 1957	3,550
56-c-1. Particle accelerator program	Nov. 25, 1957	3,600
	Nov. 29, 1957	46
Community:		
58-k-2. Housing modifications, Los Alamos	do	60
D-57-1. Municipal facilities, Richland disposal	Nov. 22, 1957	20
723-9093. 723-0052. Additional water supply and sewage facilities, Richland	do	3
Transfer appropriations and adjustment of prior year projects, all programs	Nov. 27, 1957	7,875
Grand total		39,456

JANUARY 18, 1958.

Gen. K. E. FIELDS,
General Manager, United States Atomic Energy Commission,
Washington, D. C.

DEAR GENERAL FIELDS: With reference to the Commission's letter to Mr. Durham of December 12, 1957, regarding the disposition of funds appropriated by the Congress for the Atomic Energy Commission program, the Joint Committee would appreciate receiving a more detailed breakdown on the information provided by the Commission in response to question No. 3 contained in the committee's letter of November 7, 1957.

Specifically, the committee would like to have the following information:

1. A detailed breakdown, by individual projects, of the unapportioned funds which had not been requested on a project basis as of November 30, 1957, which amounted in the aggregate to $321.2 million.

2. A listing of all projects which the Commission determined to be "specific urgent projects," pursuant to Budget Bureau requirements, together with the amount requested for each of these projects, and the date of the Commission's request for apportionment in each instance.

3. A listing of all projects for which initial apportionment was asked by the Commission but which were not classified by the Commission, for purposes of the Budget Bureau requirement, as "specific urgent projects," together with the amounts in each instance.

The committee would appreciate receiving the above information as soon as possible and looks forward to receipt of the Commission's next quarterly report, pursuant to the request of the committee's letter of November 7, 1957.

Sincerely yours,

JAMES T. RAMEY, *Executive Director.*

Mailed January 20, 1958.

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., February 4, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: In accordance with the request contained in your letter of November 7, 1957, there is submitted herewith a further report on the disposition of funds appropriated by the Congress for the atomic energy program. The information is based on funds available for the fiscal year 1958 as of January 20, 1958.

On December 17, 1957, following approval of the 1959 budget, the Commission requested the apportionment of all funds appropriated by the Congress under the "Operating expenses" appropriation with the exception of $10 million. This reserve represented a revised estimate of savings resulting from revisions in the manned aircraft reactor development program. The apportionment approved by the Bureau of Budget was $51.3 million less than the amount requested. The amounts placed in reserve include $48.6 million for cooperative power reactor demonstration projects which have not as yet been submitted to the Joint Committee on Atomic Energy, and $2.7 million for Project Sherwood pending certain program determinations by the Commission. All funds apportioned for operating expenses by the Bureau of the Budget with the exception of $6.5 million have been allotted. The unallotted balance of funds represents amounts reserved for activities which are still under consideration within the Commission. Therefore, all firm operating programs have been funded for the full fiscal year 1958 and it has not been necessary to defer any programs or subprograms.

Relative to the plant acquisition and construction appropriation, the Commission, on January 3, 1958, requested the apportionment of $127,665,000 for specific projects for which program divisions had requested funds. On January 17, 1958, the Bureau of the Budget approved an apportionment of $80,292,000 of the amount requested. Prior to the approval of the then pending request it was agreed that funds for certain projects or portions of projects could be deleted since plan were not sufficiently firm as to require immediate apportionment. There is enclosed a listing of the projects for which funds were not apportioned.

Requests for the apportionment of funds for construction which had been submitted by the Commission on an individual project basis during the period November 30, 1957, to January 2, 1958, as well as those pending on November 30, totaling $58.9 million, were approved by the Bureau of the Budget prior to January 17,

1958. The total amount, therefore, apportioned by the Bureau of the Budget under the plant acquisition and construction appropriation as of January 17, 1958, was $234.2 million. With the exception of $1.6 million representing net adjustments in the costs of approved projects and $80.3 million which was apportioned on January 17, 1958, all construction funds which have been apportioned have been allotted. Allotment action on the funds apportioned on January 17 has been initiated.

No apportionment requests are pending action by the Bureau of the Budget at this time.

Sincerely yours,

LEWIS STRAUSS, *Chairman.*

Projects for which funds were not apportioned Jan. 17, 1958

5209. Fabrication plant for fuel elements	$10,000,000
58–b–4. Pile improvements, Hanford	1,878,000
5005. Additional chemical waste facilities, Hanford	3,300,000
1016–17–18. Pl & EM, Savannah River	14,504,000
58–e–3. Fuel Technical Center, Argonne	9,080,000
58–e–4. ANP area No. 1, Arco	1,600,000
57–c–3. ANP area No. 1, Arco	4,300,000
56–j–2. Community hospital, Oak Ridge	2,711,000
Total	47,373,000

THE SECRETARY OF DEFENSE,
Washington, March 4, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
United States Congress.

DEAR MR. CHAIRMAN: This is in response to your inquiry of November 7, 1957, requesting information concerning any funds which had been appropriated by the Congress to the Department of Defense for atomic energy projects which are currently either being withheld or for which apportionment has not been requested.

As you know, the committee has held several hearings during the past year on the status of the aircraft nuclear propulsion program and an additional hearing before the Research and Development Subcommittee is scheduled for March 6, 1958. We will be prepared to discuss all aspects of this program with the committee during the forthcoming hearing.

The situation with respect to funding of other atomic energy projects which come within the scope of your inquiry is as follows:

(*a*) *Nuclear powerplant in Alaska.*—The Department of the Army has an approved program in the amount of $6,675,000 for the construction of a nuclear powerplant in Alaska. To date, the Army has requested the apportionment of $2,120,000 for design costs and long lead-time items and those funds have been apportioned. It is anticipated that the Army will request the balance of $4,555,000 in the near future so that construction can be initiated early in the spring of 1958, which marks the opening of the new construction season in Alaska.

(*b*) *Food irradiation facility.*—On May 14, 1957, the Atomic Energy Commission was informed by the Bureau of the Budget that its request for apportionment of $3 million for design of a reactor for a food irradiation facility had been rejected, "because of budget and construction policies then in effect and because of a policy question relating to the size of the facility." In July 1957, the Department of Defense Technical Advisory Panel on Atomic Energy recommended the use of a cobalt 60 source rather than the reactor proposed by the Atomic Energy Commission on the basis that such a gamma radiation source would have many advantages over the originally proposed reactor. It was subsequently determined that the language of Public Law 506, 84th Congress, would not permit the use of the Atomic Energy Commission reactor funds for a cobalt 60 facility for the Army. Since no funds were included in the fiscal year 1958 budget for the Army for this program, and since Atomic Energy Commission funds are not available for this purpose, the Department of Defense has

requested Bureau of the Budget approval of the transfer of $2.5 million of fiscal year 1958 emergency funds to the Army for the food irradiation facility. The Bureau of the Budget has informed us that this request is being approved today.

We regret any inconvenience that may have been caused by the delay in answering your inquiry. Pursuant to your request, we shall report to you on a quarterly basis concerning the withholding of any funds authorized and appropriated by the Congress for atomic energy projects, with the first such regular report covering the status as of March 31, 1958. Needless to say, we shall also continue to keep your committee fully and currently informed of any significant changes that may occur in the Department of Defense atomic energy projects.

Sincerely yours,

DONALD A. QUARLES, *Deputy.*

(Whereupon, at 12:15 p. m., Wednesday, May 14, 1958, the subcommittee adjourned to convene at 10 a. m., Monday, May 19, 1958.)

AEC AUTHORIZING LEGISLATION

MONDAY, MAY 19, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to recess, at 10 a. m. in room 304, Old House Office Building, Hon. Chet Holifield, chairman of the subcommittee, presiding.

Present: Representatives Holifield, Durham (chairman of the Joint Committee), Hosmer, Kilday, Price, Van Zandt, and Aspinall.

Also present: James T. Ramey, executive director; David R. Toll, staff counsel, George E. Brown, Jr., staff member, Joint Committee on Atomic Energy, and Bernard V. Dvoskin, GAO consultant.

Representative HOLIFIELD. The committee will be in order.

The Subcommittee on Legislation of the Joint Committee on Atomic Energy is meeting this morning to commence hearings on H. R. 12457 and H. R. 12459, bills to authorize appropriations to the Atomic Energy Commission, as requested by the AEC.

In accordance with the request of the Commission, the subcommittee has agreed to begin the hearings this morning with testimony on H. R. 12457, a bill to amend Public Law 85–162 and Public Law 84–141 to increase the authorization for the fiscal year 1958 and fiscal year 1956 programs, to provide increased amounts for the Project Sherwood plant and the particle accelerator program.

(H. R. 12457 appears on p. 18.)

Representative HOLIFIELD. The Commission has also furnished the subcommittee unclassified statements concerning the increase of $2,250,000 requested for the Project Sherwood plant, and the $9,406,000 requested for the particle accelerator program.

Without objection, I would like to insert in the record at this point the two unclassified description sheets, as furnished by the Atomic Energy Commission.

(The information referred to follows:)

58–c–6 Project Sherwood plant, $10,000,000

This project was authorized under the same title for fiscal year 1958 at $7,750,000. A revised cost estimate totaling $10 million now calls for new authorization.

The project provided for the construction of supporting installations necessary at the several sites where controlled thermonuclear research is in progress. The program which has as its goal the controlled release of energy from the fusion of light nuclei is being actively pursued at four major sites (University of California Radiation Laboratory at Livermore, Oak Ridge National Laboratory, Princeton University, and Los Alamos Scientific Laboratory), and is supported by smaller projects at a number of other sites.

The principal elements comprising the project are set forth below with a comparison to the previously authorized amount.

	Previous authorization	Proposed authorization	Change
1. Princeton University	$5,600,000	$8,600,000	$3,000,000
2. Sherwood Bldg., Livermore	0	900,000	900,000
3. Additional power, Livermore and Berkeley	550,000	500,000	−50,000
4. Unforeseen construction	1,600,000	0	−1,600,000
Total	7,750,000	10,000,000	2,250,000

One of these requirements ($8,600,000) provides for a two-phase construction program on long-term leased or purchased land at Princeton University. The first phase will provide office, laboratory, and other supporting installations for the scientific and operating staff required for the experimental program and for the initial assembly and testing of components for the device. The second phase consists of the building to house the model C device and for the associated energy storage, pulsing equipment, and related mechanical equipment. The increase in the estimated cost for these installations is due primarily to a required increase in the size and height of the building to house the model C device and an increase in the cost of the powerhouse and transmission line based on preliminary contractor design studies. The device and associated energy storage, pulsing equipment, and related mechanical equipment, estimated to cost $26 million, are budgeted under appropriation "Operating expenses." It is expected that experimentation with the device will begin in fiscal year 1960.

The second and third known requirements cover construction at the University of California Radiation Laboratory at Livermore and Berkeley. One item of $500,000 will provide for additional power faciilties for the various experimental devices at Livermore and Berkeley. The other item of $900,000 will provide additional laboratory space for the expanding Livermore program. This item has been authorized by the Commission and design of the building is under way.

The cost elements pertaining to this project are as follows:

Princeton University, model C:		
Phase I: Engineering design and inspection ($283,000 from prior year project 57–c–7):		
Improvements to land, utilities, and site development		$587,000
Buildings		938,000
Equipment		475,000
Contingency		75,000
Total, phase I		2,075,000
Phase II:		
Engineering design and inspection	$460,000	
Buildings	3,215,000	
Utilities	1,805,000	
Site development	70,000	
Equipment	365,000	
Contingency	610,000	
Total, phase II		6,525,000
Total, model C		8,600,000
Sherwood Bldg., Livermore:		
Engineering design and inspection		60,000
Improvements to land		5,000
Building		660,000
Utilities		40,000
Equipment		60,000
Contingency		75,000
Total project cost		900,000

Additional power, Livermore and Berkeley:	
Engineering design and inspection	$25,000
Building	176,000
Utilities	104,000
Equipment	155,000
Contingencies	40,000
Total project cost	500,000
Grand total	10,000,000

56-c-1 Particle accelerator program, $19,406,000

This project was originally authorized in the Commission's fiscal year 1956 Authorization Act in the amount of $10 million. It provided for the construction of two high energy accelerators estimated to cost about $5 million each, to be based on proposals submitted by universities. In fiscal year 1956 the Commission accepted proposals from a Harvard-Massachusetts Institute of Technology group for a 6 Bev electron accelerator estimated to cost $6.5 million, and from a Princeton-University of Pennsylvania group for a 3 Bev proton accelerator estimated at a cost to the Commission of $5.8 million, in addition to which Princeton-Penn would contribute $0.5 million of their own funds to provide an accelerator costing in total $6.3 million. Thus, based upon these two proposals the total cost to the Commission was estimated at $12.3 million, which amount was within the 25 percent overrun provision applicable to this project. Accordingly, contracts were negotiated and design and construction authorized to start.

On the basis of a recent cost reanalysis based on more complete design data, it is now apparent that both of the accelerators will overrun the original estimates as follows:

[In millions]

	Original estimate	Latest estimate	Increase
Harvard-MIT	$6.5	$8.2	+$1.7
Princeton-Penn	5.8	11.2	+5.4
Total	12.3	19.4	+7.1

An analysis of the increase in each case is as follows:

	Millions
Harvard-MIT:	
Increased magnet costs	$0.4
Increased university salary costs	.1
Higher design costs	.1
Contingency	1.1
Total	1.7
Princeton-Penn:	
Increased shielding costs due to change in minimum exposure standards	.5
Increase in labor and material costs	1.0
Higher design costs	.5
Increased construction costs due to increased complexity of accelerator and more stringent design criteria	1.1
Increased project administration	.1
Preoperational testing of accelerator	.2
Contingency	2.0
Total	5.4

While construction has been initiated in both cases, at Princeton the accelerator per se has not as yet been started. In view of this, together with the magnitude of the increased costs involved, the Commission has placed a stop order

on the Princeton machine pending approval of a revised amount of authorization. Accordingly, the status of the project funds are as follows:

	Millions
Revised estimate of the Harvard-MIT accelerator	$8.2
Cost and commitments as of Jan. 31, 1958, for Princeton-Penn accelerator	2,2
Total funds currently programed pending amendment of authorization	10.4

Representative HOLIFIELD. Following the testimony on H. R. 12457, the subcommittee will proceed to receive testimony on H. R. 12459, the Atomic Energy Commission authorization bill for the fiscal year 1959 program as requested by the Atomic Energy Commission.

The subcommittee will begin with project 59-a-1, and proceed project by project, except for those pertaining to reactor development, which will be covered at a later date.

Our principal witness this morning is Mr. K. E. Fields, the General Manager of the Commission, who is accompanied by various members of the Commission's staff.

We are glad to have you here with us this morning, Mr. Fields. Will you please proceed?

STATEMENT OF K. E. FIELDS, GENERAL MANAGER, ATOMIC ENERGY COMMISSION, ACCOMPANIED BY DON BURROWS, CONTROLLER; FRANK McCARTHY, ASSISTANT CONTROLLER FOR BUDGETS; W. K. DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; J. H. WILLIAMS, DIRECTOR, DIVISION OF RESEARCH; P. W. McDANIEL, DEPUTY DIRECTOR, DIVISION OF RESEARCH; E. J. BLOCH, DIRECTOR, DIVISION OF PRODUCTION; JOHN A. HALL, OFFICE OF INTERNATIONAL AFFAIRS; DR. C. L. DUNHAM, DIRECTOR, DIVISION OF BIOLOGY AND MEDICINE; JOHN A. DERRY, DIVISION OF CONSTRUCTION AND SUPPLY; FRANK K. PITTMAN, OFFICE OF INDUSTRIAL DEVELOPMENT; AND DAVE ANTHONY, BUDGET OFFICER FOR THE DIVISION OF MILITARY APPLICATION, ATOMIC ENERGY COMMISSION

Mr. FIELDS. Yes, sir.

I have one question, Mr. Chairman, before we proceed.

In the reactor items, there are a number that are not related to civilian power, as you know. I do not believe it is clear to me whether you intend that they would come up later or perhaps we could deal with them as we go down through the 1959 authorization bill as we come to them.

Representative HOLIFIELD. Let us decide that as we get to it. I have no strong feelings one way or another on that point.

Mr. FIELDS. It might expedite your hearings if we took the military projects and such things as that.

Representative HOLIFIELD. I think that would be all right.

Mr. FIELDS. Yes, sir.

One further thing, before we proceed; I would like to introduce Dr. John Williams, who was recently appointed as Director of Research. He comes from University of Minnesota where he has been professor of physics for a long time. He is preeminent in the field of high energy physics. The Commission is very pleased in having him with us.

Representative HOLIFIELD. We are very glad to have him here this morning.

I think you testified once before on the basic research program before Mr. Price's committee.

Dr. WILLIAMS. I did, sir.

Representative HOLIFIELD. We are glad to have you here as a permanent contributor.

Mr. FIELDS. With respect to the items for the modification of prior year authorizations, I wish to ask Dr. Paul McDaniel, who is the Deputy Director of the Division of Research, to speak to these projects.

Representative HOLIFIELD. Very well.

Dr. MCDANIEL. Project 58–e–6, Project Sherwood plant; a request for $10 million of authorization, relates to 4 individual items previously authorized at a level of $7,750,000. The first of these four items is at Princeton University, previously authorized at $5,600,000; the proposed new authorization, $8,600,000.

The second item relates to a building at the Livermore Laboratories, now under design and on which construction work is about ready to begin. Nothing was in the previous authorization for this item. The building will cost $900,000.

The third item is for additional power facilities for Livermore and Berkeley. The previous authorization was $550,000. The work has been completed but it only cost $500,000, a saving of $50,000.

Item 4 in the previous authorization was a contingency of $1,600,000. We are proposing no contingency in the new authorization.

The increases in the total project are due primarily to the increase in cost of the Princeton University accelerator devices from $5.6 million to $8.6 million.

Chairman DURHAM. You requested $5,250,000, and you were granted $2,250,000. What about that?

Dr. MCDANIEL. What was your question, sir?

Chairman DURHAM. Is that the same project for which, AEC requested $5,250,000 and the Bureau of the Budget granted $2,250,000, for project 58–e–6. The other item you requested was $2 million in project 59–d–11, but you are still short $1 million in your requests to the Bureau of the Budget.

Mr. FIELDS. The latter item is a new project in the fiscal 1959 authorization for $2 million. It is to allow construction to go forward in the event there are developments in the thermonuclear field which indicate a need for additional construction. It may well be that in this very rapidly moving field, additional experimental models will have to be built as the development proceeds. The 1959 item is really unforeseen construction.

At this time there is no longer a reason to continue a contingency item in 1958. We are trying to pinpoint what we intend to do in 1958, but we still need that reserve in 1959 so that we can exploit the new things that come along in the program. We are speaking now to the 1958 item which did, as I recall, start out at $5 million.

Dr. MCDANIEL. It was based on $3 million for Princeton and $2 million for contingency.

Chairman DURHAM. Has the project been delayed?

Mr. FIELDS. I don't think the project at this point has been delayed.

Chairman DURHAM. Not getting the funds you requested would not delay it, in your opinion?

Mr. FIELDS. No, sir. These areas of the Sherwood project are not like other construction projects in any sense. They take a great deal of engineering, research, model study and development work to really come up with a fairly firm cost estimate.

This project was not initiated, on the basis of engineering detail that we would ordinarily desire.

Chairman DURHAM. The money granted by the Bureau of the Budget will continue the project?

Mr. FIELDS. Yes, sir. The project is going along. After the fiscal year 1958 authorization a very competent architect and engineering firm has been engaged. Allis-Chalmers and RCA, as a team, have been brought in to study this in great detail and to design the buildings. It has been determined that the building must be quite a bit larger and will be much more expensive then originally believed.

The power supply for this stellerator is quite demanding and results in an increase in the cost. We now are more fully aware of what it takes to do this kind of a project. It is one of the important projects in the Sherwood program and we think it has developed a considerable amount of very useful information. It is a project that should proceed.

We have had steering committee meetings many, many times on these projects and this is the one which they felt should move forward in a much larger facility and with much bigger apparatus.

Chairman DURHAM. Is that Dr. Smyth's opinion?

Mr. FIELDS. I am quite certain he joins in it; yes, sir.

Mr. RAMEY. In your budgeting for these items, do the funds authorized here cover the actual gadget itself or just the building and facilities?

Mr. FIELDS. These funds cover only the permanent parts of the facility, i. e., of the building, the power supply, and that type of thing. The actual stellerator machine, because it is clearly an experiment and a temporary facility, is covered in the operating budget. Our present estimate of the cost of the equipment and everything that goes in it is $26 million.

Mr. RAMEY. The reason I asked that question is that we raised some questions similar to this in the basic research hearings as to whether or not you would enlarge the size of your projected machines due to the British experience with Zeta.

Dr. MCDANIEL. This machine is quite unrelated to the British Zeta type machine.

Mr. RAMEY. I meant the Livermore arrangement.

Dr. MCDANIEL. The Livermore requirement for additional power and for the Sherwood building to house the additional facilities is not related to the British Zeta effort. We have entirely different approaches.

Mr. RAMEY. On your operating money for the machines, for example, will you be requesting additional funds possibly for larger tubes, and so on?

Dr. MCDANIEL. That has been taken into consideration.

Representative HOLIFIELD. Have you changed the classification from physical research to reactor development?

Mr. FIELDS. The project is still carried in the reactor division budget. It is a large development machine. We have all along carried it in the Reactor Division budget because of its size and scope. It is actually under the supervision, however, of the Research Division.

Representative HOLFIELD. There has been some money held back by the Bureau of the Budget in other basic research projects. Is it definite that this construction will go forward or will it be held back?

Mr. FIELDS. I am quite convinced it will go forward. It is moving ahead rapidly at this time.

As Dr. McDaniel said, the Sherwood building at Livermore has been designed. We think it will be put out for bids in late June. We are almost ready now. The Sherwood work had been proceeding rapidly at Princeton. There has been no holdup on that.

Representative HOLIFIELD. Will the Livermore program take care of all of the additional laboratory space you need?

Mr. FIELDS. No, sir. We have a $2 million item in the 1959 bill which we feel may be necessary for additions at Livermore or Los Alamos as developments accrue during the year.

Representative HOLIFIELD. That is the 2 million you are carrying forward?

Mr. FIELDS. That is the 2 million in the 1959 bill.

Mr. RAMEY. At the present time, the Livermore facilities are housed on the balconies in this old MTA building and some hangars?

Mr. FIELDS. That is right.

Mr. RAMEY. Will the new facilities provided for here and in your 1959 budget move those existing machines out?

Dr. MCDANIEL. They will house those parts that are required to be moved.

Mr. FIELDS. We will still be using the Materials Testing Accelerator Building for the Sherwood project.

Dr. MCDANIEL. That is right.

Representative HOLIFIELD. Are there any further questions on that project?

If not, we will move forward to the next one.

Dr. MCDANIEL. That is Item 56–c–1, entitled "Particle Accelerator Program." Congress originally authorized this project in the 1956 authorization act in the amount of $10 million. It provided for the construction of 2 high-energy accelerators at $5 million each. After considerable study, the Commission awarded contracts to two groups of universities. One is the University of Pennsylvania and Princeton University group, and the second is the Harvard and MIT group.

The original cost estimate for Harvard-MIT machine, which is a 6-billion-volt electron accelerator, was $6.5 million. Our latest current cost estimate indicates that the cost for that machine will be $8.2 million, or an increase of $1.7 million.

The Princeton-Pennsylvania accelerator, a 3-billion-volt proton accelerator, was originally estimated to cost $5.8 million plus a half-million-dollar contribution from the 2 universities, or $6.3 million in total. It is now estimated to cost $11.2 million, plus the half-million dollars from the contribution.

The cost increase at Princeton-Penn is $5.4 million. Therefore, the total increase over the original estimate is $9.406 million, of which $2,300,000 has been previously financed. We need authorization now

for $19,406,000 and an increase of $7.1 million over the amount presently funded.

On the Harvard-MIT accelerator, the increase of $1.7 million is due in part to increased magnet costs of $400,000. There was also a salary increase for the university staff which accounted for $100,000. The design costs were somewhat higher than anticipated, by about $100,000 extra.

We have included a contingency in the requests of $1.1 million. Our engineers advise us that it will require $8.2 million to complete the construction.

At Princeton-Penn, the reasons for the cost increase are detailed on page 1 of the document which was put in the record and I won't go into all of them. There is a contingency in that item of $2 million which our New York office advises us is necessary in order to insure the completion of the accelerator.

Representative HOLIFIELD. In spite of the fact that you are further along in your construction and you have now had an opportunity to reassess your costs, you still include practically the same amount of contingency as you had to begin with.

Dr. MCDANIEL. The construction of accelerators is a new and unusual endeavor even for the scientists at Harvard and MIT and Princeton and the University of Pennsylvania. There are many things that the scientists just do not anticipate but which surely turn up.

It has been the experience of those who build accelerators that after one estimates the cost with the best precision he can early in the game, there still are many unknown factors that come in to increase the cost as the years go along.

Chairman DURHAM. Is there much difference in the design of these and the others that we have built?

Dr. MCDANIEL. It is not fair to say that the Harvard-MIT machine is a conventional design. There is a great deal of new effort going into it. The Princeton-Penn accelerator is somewhat similar to the cosmotron at Brookhaven, but it does have design features which make it unique. It is not a simple thing of going back to the original design of the cosmotron and design the new machine from it.

As a matter of fact, Dr. White, the designer of the Princeton-Penn accelerator was the designer of the cosmotron at Brookhaven. So all of that experience has been directly related to the Princeton accelerator design.

Mr. FIELDS. We have had considerable experience in the last year or two with the operation of the cosmotron at Brookhaven and the bevatron at Berkeley. Included were unfortunate experiences, with the machines being closed down. We had a magnet failure at the cosmotron. Our experience led to a redesign of these machines.

It is clear that there are increased requirements for these new machines. These requirements have come out of the experience with these very new machines.

As I said before, these kinds of machines have never been built before.

Representative HOLIFIELD. These are different from the bevatron at Berkeley?

Mr. FIELDS. They are some somewhat different.

Dr. McDaniel. The bevatron is a 6-billion electron volt proton accelerator, the Harvard accelerator is a 6-billion electron volt electron accelerator, and the Princeton-Penn accelerator is a 3-billion-volt proton accelerator.

The cosmotron is down for repair. As General Fields pointed out, there was a short in some of the current carrying coils. That will be in operation by about Christmas or the first of the year.

The bevatron had a slight accident recently, and is off the air for another 2 or 3 weeks. After that time it will come back into operation on a partial basis.

Mr. Ramey. So if you had one other big machine operating right now, you would be able to do a good deal more research?

Dr. McDaniel. We have no machines in the multibillion electron volt range which are now operating.

Representative Holifield. The Princeton accelerator, this is the same type of accelerator as your Berkeley accelerator for protons, except smaller?

Dr. McDaniel. It is smaller. It is more closely allied to the cosmotron at Brookhaven.

Representative Holifield. Is this necessary because of additional need for research?

Dr. McDaniel. The workload at the cosmotron when it is operating is scheduled for many, many months in advance. The estimate is that when the Penn-Princeton accelerator is completed, it also will be crowded and full of experiments.

One specific item about the Princeton-Penn accelerator is its high intensity. It may have a thousand times the intensity of the cosmotron, thereby permitting a greater range of experiments.

Representative Holifield. How about the bevatron?

Dr. McDaniel. We have no machine under construction in the bevatron range. It is a 6-billion-volt proton accelerator. The machine at Harvard-MIT is a 6-billion-volt electron accelerator and is designed to do different experiments.

Representative Holifield. How does the Princeton machine compare with the Berkeley machine?

Dr. McDaniel. The Berkeley machine, when operating, is fully scheduled on 3 shifts a day, 7 days a week. As I said, it is not functioning for the moment and will be off for 3 weeks.

Representative Holifield. What are the technical advantages if any, or is it just a duplication?

Dr. McDaniel. It is for additional facilities, insofar as the bevatron is concerned, with higher intensity.

Representative Holifield. The bevatron goes to 10?

Dr. McDaniel. It goes to six billion electron volts.

Representative Holifield. This will go to three?

Dr. McDaniel. Yes, sir; but with 1,000 times higher intensity.

Mr. Ramey. Has holdback of funds impaired your running of 3 shifts instead of 2 shifts on the bevatron?

Dr. McDaniel. There may have been a small time delay for a little while, but the third shift is now authorized and everything is going along.

Mr. Ramey. How many months did this holdback affect you? Was it 6 months?

Dr. McDaniel. I have no clear recollection of how long.

Representative HOSMER. Is that the Berkeley machine you are talking about?

Mr. RAMEY. Yes, sir.

Mr. FIELDS. I don't believe it was 6 months. I don't recall when the cosmotron was shut down.

Dr. MCDANIEL. About the first of January.

Mr. FIELDS. I believe that funds for the increased shifts at Berkeley were in hand about March. I am not sure. We could check that and let you know.

Representative HOSMER. I am wondering, irrespective of funds, if you are getting as much use as you could out of that Berkeley machine if you had that engineering building for the purpose of staging experiments and getting them in there fast, and when they are through getting the next one in there fast. I am talking about the engineering building.

Dr. MCDANIEL. It would help.

Representative HOSMER. You have a tremendous investment in the Berkeley machine and it seems to me illogical not to put this other building in in order to realize the maximum amount of that investment. I am wondering why it did not come up again this time. I think there is $1,100,000 necessary to put the building in.

Dr. MCDANIEL. I believe it was estimated at $1 million, yes.

Representative HOSMER. Do you know how much more you would get out of the Berkeley machine with that building?

Dr. MCDANIEL. It is quite difficult to assess or to assign a number to that, but certainly it would be more efficiently operated.

Representative HOSMER. Do you know why it was not requested at this time?

Mr. FIELDS. Mr. Hosmer, it was under consideration, as I attempted to explain on Wednesday. It was one of the projects that has been on our list for consideration. We have not been able to fit it within the overall fiscal limitations.

Representative HOSMER. We are talking about a machine that is already in existence at Berkeley, whereas, in this appropriation item, we are talking about machines of sometime in the future. It seems to me if we have something, we ought to make maximum use of it.

Thank you, Mr. Chairman.

Representative PRICE. Mr. Chairman, while we are on the subject of accelerators, since it touches so closely on basic research, and we have Dr. Williams, the new Director of the Research Division, I wonder if we could have an enunciation from him on his philosophy on the level of support of basic research within the atomic energy program?

Mr. WILLIAMS. You are referring to the accelerator program, Mr. Price?

Representative PRICE. The whole level of support of the basic research program within the Atomic Energy Commission.

Mr. WILLIAMS. As you recognize, I have just come on board on this problem and you are asking me what my philosophy will be about it.

Representative PRICE. You can have your own philosophy, without being in the present position, on the matter of basic research.

Mr. WILLIAMS. I certainly have a very dynamic philosophy about basic research, and I consider it to be my job in the Commission to promote that aspect of it.

Representative PRICE. Even before you took over your new assignment, you must have had some idea of the level of support within the Commission of basic research.

Do you think we have a sufficient level of support or do you think we are lagging, or do you think it should be stepped up?

Mr. WILLIAMS. One has to fit it, essentially, into the overall fiscal support of the atomic energy program. The fraction of that which goes to research is determined by the Commission. We have had very wonderful support from the Commission in this basic research program.

However, it is always possible and, from the point of view of the scientist, highly desirable, to increase that level of support.

Representative PRICE. I don't know whether you have been in charge of the Research Division long enough to be involved in the budgetary setup for 1959. Do you think the level of support as indicated in the fiscal 1959 budget is sufficient to meet the demands or the recommendations of the General Advisory Committee and the people who are working in the laboratories of the Commission for a stepup in basic research within the Commission?

Mr. WILLIAMS. As far as the 1959 budget is concerned, sir, we have before us here today—not today but in the near future—certain requests for authorization for construction projects. These take care of the demands that were made prior to my coming on board and I would like your question really on the 1959 budget to be directed to the people who were there prior to my time.

Representative PRICE. I understand that there are only two projects in the 1959 budget that have any direct bearing on basic research and they seem to be pitifully small projects. Do you have any comment on this situation?

I may be taking unfair advantage of you. You may not have had time to get your feet wet as Director.

Mr. WILLIAMS. I am familiar with these requests.

Representative PRICE. Do you think that is an adequate start on the matter of basic research?

Mr. WILLIAMS. The request is specifically included in the 1959 supplemental budget to take care of the needs of those projects.

Representative PRICE. Of two very small items. Mr. Hosmer touched on one there.

Even before being in the position as Director, you must have had some idea on that. He touched on the problem of space and pointed out how at Berkeley, where we have been in business for many years, they still have this problem of space. Do you not think something ought to be done about that?

Mr. WILLIAMS. It is my plan, sir, to make an overall study of the accelerator facilities as one area of research in the very near future to develop policy, and if possible, deciding on the relative merits of supporting what we have, as Mr. Hosmer has said, what we have under construction, and what should occur in the future.

Representative PRICE. In the case to which Mr. Hosmer referred, you would probably get twice or 3 or 4 times as much use from the bevatron if you had adequate space to work in?

Mr. WILLIAMS. No, that would be an overestimate.

Representative PRICE. Maybe twice as much?

Mr. WILLIAMS. I still think that is an overestimate. We are working 24 hours a day now.

Representative PRICE. How much more work would you get out of it?

Mr. WILLIAMS. That would be an out-and-out guess but a rather informed guess on my part.

Representative PRICE. I am talking about the facilities that go with it. There are other things besides the space problem. Space is one of the problems?

Mr. WILLIAMS. Yes, sir.

Mr. FIELDS. I think it is only fair to say that Dr. Williams has been with us for a short time.

Representative PRICE. I meant in his present position.

Mr. FIELDS. Yes, sir. I think his philosophy is going to be the right one to see that the Research Division is fully supported. He gives every evidence of that.

I might say that our supplemental budget estimates for the operating budget will be forwarded soon. We do have some amendments coming along. We will be able to see this problem in better perspective when we get this processed.

Representative PRICE. I want to say, Mr. Fields, that any criticism I might direct at basic research would not be directed at the Commission. I think the Commission would do everything it could in this field that it is permitted to do within the budgetary restrictions.

Mr. FIELDS. Yes, sir. I think there will be a full review by the Research Division, and particularly as to what the national policy should be in the field of high energy physics. I am sure there will be a full review of the laboratory facilities in question.

Representative PRICE. Let me ask this question:

Is it true or is it not true that the General Advisory Committee to the Atomic Energy Commission has recommended a stepup in the basic research projects?

Mr. FIELDS. We have recommendations from them with respect to basic research, particularly in the field of high energy physics. They concur in the need for a review of the entire policy.

Representative PRICE. Do they place any percentage on the amount of stepup on these programs?

Mr. FIELDS. I don't recall the exact recommendation, but it was for some increase. I believe the letter which you had from Mr. Johnson was from Mr. Johnson as an individual.

Representative PRICE. What was his personal recommendation? He is chairman of the general advisory committee, but I understand his recommendations were made on a personal basis.

Mr. FIELDS. As I recall, it was on the order of an increase of twenty or twenty-five million dollars in our base. I do not have his letter here.

Representative PRICE. I think that he recommends a stepup of the order of from 50 to 150 percent in the basic research program.

Mr. FIELDS. That could be. I believe he sent you a letter.

Representative PRICE. Yes. I think he sent a letter to the Commission. As a matter of fact, he sent me the copy of the letter that he sent to the Chairman of the Atomic Energy Commission on February 20.

Mr. FIELDS. I do not recall the amount he had in the letter, but it did recommend an increase.

Representative PRICE. The increase was in the neighborhood of from 50 to 150 percent in our basic research effort. I think the letter should be included in the record.

Representative HOLIFIELD. Without objection, it will be received.

(The letter referred to follows:)

FEBRUARY 20, 1958.

Mr. LEWIS L. STRAUSS,
Chairman, United States Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: During the past few months I have given considerable thought to the problem of financial support for the activities of the Division of Research of the Atomic Energy Commission. It is becoming more and more evident that the present level of support, namely about $71.5 million for fiscal 1958 and fiscal 1959 is greatly inadequate. Furthermore, unless considerably more support is forthcoming with the next 2 or 3 years, we shall find ourselves in a difficult position.

For the support of this conclusion, I would like to present a few facts pertaining to some of the programs under the sponsorship of the Division of Research. At the present time about $16 million is devoted annually to the support of high-energy physics. Nevertheless, these funds do not enable the cosmotron at the Brookhaven National Laboratory and the bevatron at the University of California Radiation Laboratory to operate on a full schedule. In addition, these laboratories have been in a position to accept only about 40 percent of the requests that come to them for the use of the accelerators for worthwhile experiments, and many other physicists and teams in universities throughout the country do not even apply for machine time, since it is apparent that none is available. Four new high-energy accelerators are now under construction and will go into operation during the period 1960–62. These are the 25–30 Bev. AGS machine at Brookhaven, the 12.5 Bev. accelerator at the Argonne National Laboratory, the 3 Bev. synchrotron at Princeton and the Harvard–MIT 6 Bev. electron synchrotron at Cambridge. It has been carefully estimated that when these machines go into operation, about $50 million will be the annual operating and experimental expense to maintain them on a full-time basis. We are certain that when this time arrives there will be even more demand for the use of the machines than available machine time will permit. The estimate made here is based on present-day dollars; any inflationary trend will increase the operating costs.

It should also be pointed out that other high-energy machines, such as cyclotrons, linear accelerators, et cetera, that are included in this program are not being used to capacity. If one considers it important to use our manpower as efficiently and effectively as possible, then there is the need to maintain all of our experimental devices in the field of high-energy physics at full capacity. In other words, it appears to me that our manpower resources should take precedence in our effort to maintain leadership in the field of high-energy physics. This statement applies equally to all other fields in the atomic-energy program.

Another field that deserves increased attention is what one might call in general terms "the science of materials." Included in this expression are such areas as chemistry, metallurgy, solid-state physics, high-temperature thermodynamics, ceramics, the behavior of materials in a radiation field, et cetera. Our efforts in the fundamental sciences pertaining to these areas have been greatly inadequate. In fact, the difficulties we have experienced in the development of different types of reactors, not only for power but for military propulsion purposes, as well, have been due in a large measure to lack of fundamental knowledge in these fields. Due to the unrealistic time schedule, we have spent relatively large sums of money for pieces of hardware without knowing what components would be contained within them. By lengthening the time schedules for completion of some of our reactors for both military and nonmilitary purposes, it will be possible to devote more attention to the fundamental problems inherent in the behavior and use of materials than we have in the past. In fact, these fundamental problems must be solved before we are able to complete the programs. It is therefore recommended considerable additional funds be devoted by the Division of Research to this area for the support of

fundamental research in the laboratories of the Commission, the universities and institutes throughout the country.

A number of other activities sponsored by the Division of Research need additional support. However, in my opinion, the two general areas previously mentioned demand the greatest attention.

What I would like to emphasize is that our greatest asset is well-trained scientific and engineering personnel and that we should give them full support in order to enable them to carry out their work to the capacity of their talents. I would estimate that the annual operating budget of the Division of Research at the present time should be at least $100 million to accomplish these objectives and that within the next 4 years this annual budget should rise to $150 million to $175 million to make the fullest use of our manpower and facilities commensurate with the needs and objectives of the Atomic Energy Commission's program.

Sincerely yours,

WARREN C. JOHNSON.

Representative PRICE. I am not criticizing the Commission. I recognize the limitations under which you work. This is an important thing. We had a pledge to the country after sputnik the first that we are going to do something about it. The indications are that we are talking about it, but not doing anything about it.

That is all I have, Mr. Chairman.

Representative HOLIFIELD. We have before us the full unclassified list of the projects. They have been submitted already for the record and our method of procedure, if the committee agrees, will be to take them one at a time. In some instances we have questions which the staff have provided for specific projects and at all times questions from the members of the committee will be in order. So as we go through them, we will accept the statement as prepared, which has already been accepted as part of the record, and will try to develop certain points which cause questions in the minds of some members of the staff of the committee.

Mr. FIELDS. Mr. Chairman, would you wish to deal with the remaining two items in the Research Division before we start at the beginning of the 1959 bill or not?

Representative HOLIFIELD. We can do that and take them out of order.

Mr. FIELDS. There are actually three. There is project 59–d–11, which is the project Sherwood item of $2 million. The other two items are project 59–e–1 and e–2, which are accelerator improvements at the University of California Radiation Laboratory and CP–5 reactor improvements at Argonne National Laboratory, respectively.

Representative HOLIFIELD. We can take those out of order as long as we are on this subject. What page in your unclassified presentation is the first one?

Mr. FIELDS. It is on page 37 of the unclassified analysis statement.

Representative HOLIFIELD. You have already made your presentation on that.

Mr. FIELDS. We have on the project Sherwood plant at 2 million; yes, sir.

Representative HOLIFIELD. Why do we not just come to them in order because you have prepared a presentation, unless you have something which you wish to add to it.

Mr. FIELDS. No, sir.

Representative HOLIFIELD. Then we will go with the Chair's suggestion; 59–a–1, $15 million. We have the backup material for that here?

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. Our existing processing facilities at Hanford, Oak Ridge, and Savannah River, are they adequate to take care of our production?

Mr. FIELDS. I am going to ask Mr. Bloch, the Director of the Production Division, to speak to these matters.

Representative HOLIFIELD. Very well.

Mr. BLOCH. Yes, sir; our existing separations facilities are quite adequate and we have some reserve capacity.

Representative HOLIFIELD. Then are these plant modifications and additions to do the chemical processing of spent fuels from the forthcoming civilian reactors, such as Yankee and Consumers?

Mr. BLOCH. The item is for plant modifications necessary to process fuels which will be coming back from various power reactors, and also fuels that will be coming back from various military reactors.

Representative HOLIFIELD. Will this provide sufficient facilities to cover the requirements of the power demonstration reactors for which AEC has now contracted?

Mr. BLOCH. Yes, sir.

On the basis of the studies we have made so far, and these are very preliminary estimates, it appears that these funds would place us in good position to process fuels which will be coming back from industry for quite a period of years.

Representative HOLIFIELD. Will it also cover the proposals which are now being negotiated by the Commission?

Mr. BLOCH. There would be capacity for that, sir.

Mr. FIELDS. Mr. Chairman, in these kinds of reactors, even military reactors, there are alloys and materials in the fuel elements that are not present in fuels for the production reactors. There are different enrichments also from the production reactors. They vary from unenriched, or even depleted, on up to highly enriched materials.

For this reason, modifications are necessary to dissolve parts. These include changes to the head ends, the piping, and all kinds of changes of this nature; and even changes in waste storage.

Representative HOLIFIELD. These are not merely additions to existing processing facilities; they are in some instances different types of processing? You carry your processing into other stages?

Mr. BLOCH. Generally, the bulk of the work is associated with what we call the head-end treatment; that is, handling the fuels and dissolving them before they go into the extraction systems.

Most of this money would be for so-called head-end treatment to get these new kinds of fuels into solution. Once in solution, we can, by and large, put them through the solvent extraction systems in our existing plants. There may be some minor modifications in the extraction section, but it would not be significant. So our development work is essentially aimed at trying to come up with processes and facilities which will dissolve these various types of fuels, different alloys, different enrichments, so that they can go on through our existing plants.

Chairman DURHAM. These facilities will all be built at existing plants?

Mr. BLOCH. Yes, sir.

Chairman DURHAM. It is just an addition to the plants?

Mr. BLOCH. Yes, for example, at Hanford where we think we can handle most of the so-called low enrichment fuels, we visualize going into one of the old canyons that is currently shut down, using a part of it for storage and dissolver sections, and having a pipeline from there to our Redox plant.

Chairman DURHAM. Congress is a little bit in a mood now not to go out and build new facilities on new unselected sites. Are there any projects in your unclassified list at all where you are going to have to go out and purchase land, build entirely new housing facilities and everything else?

That is the first thing we ask them in the military now in the other committee.

Mr. FIELDS. I do not believe there are any in our 1959 program, Mr. Durham. There is some acquisition of land at Arco, but that was authorized in 1958.

Chairman DURHAM. That is in addition to what you have already acquired there?

Mr. FIELDS. Yes, sir.

Chairman DURHAM. That is not an entirely new facility. What I am speaking of is where you are going to have to go out and build an entire new facility; water, sewage, housing, and everything else.

Mr. FIELDS. No, sir. There is nothing in this bill that involves the construction of housing areas or anything of that nature. There will be some construction on land that we will not acquire, but on which we would get long-term leases as in the case of the Puerto Rico medical center and in the case of the Princeton project. There is no acquisition of land involved in the projects in this bill.

Chairman DURHAM. The Government owns most of the land now, and that is the reason I am asking the question.

Representative HOLIFIELD. In early 1957, the AEC announced its reprocessing policy. I believe it is on page 518 of the hearings last year. You had in there an estimated cost of a little over $20 million for chemical processing plants. Do you plan to make additions to the existing facilities rather than to build a separate $20 million plant?

Mr. BLOCH. Yes, sir; we do. There are several reasons.

One, it appears to be cheaper.

Secondly, we can defer actual construction longer since we are going to make modifications to existing plants it will take us less time to get a facility into operation. This gives us flexibility and also gives us more time to work on development of the processes.

So it seemed to us that this approach of using what we had with what modifications were necessary was a better approach from the standpoint of flexibility and cost.

Representative HOLIFIELD. You announced $15,300 a day, I believe it was, as a processing cost as a kind of standard to go by to charge private reactors for reprocessing their fuel elements. That, I believe, was based on the $20 million cost of the plant.

Mr. BLOCH. Yes, sir.

Representative HOLIFIELD. Now you are asking for $15 million. Does this mean, first, that you have decided you can build the facilities needed for less, or is it a reduction in the scope of the facilities you had planned?

I will wait there for the answer to those two.

Mr. BLOCH. No, sir; it is not a reduction in the scope of the facilities. The program as we visualize it now, would handle all of the fuels that were contemplated by the $20 million plant.

Representative HOLIFIELD. My question to you, then, is will the $15,300 a day processing cost be reduced in view of the 25 percent reduction in capital plant expenditures?

Mr. BLOCH. There are a number of elements that go into making up the cost in addition to the capital expenditures, such as operating and waste storage costs and also the extent to which we might charge against this program the amortization of the plants already built and which we will be using. This project is still in its very early stages.

On the basis of the sketchy information we now have, we have made some estimates of processing costs for various type fuels based on the formula that was used for the conceptual plant, and it appears to us that with this approach we can do the job within the costs that are comparable to those in the conceptual plant.

Representative HOLIFIELD. So the industry should be alerted to the fact that this difference in cost does not necessarily mean a difference in your processing charges?

Mr. BLOCH. That is right. The basis for charging for the services is the formula that was published in the Federal Register.

Mr. TOLL. In view of your plans to build specific facilities for particular types of spent fuel rods under this project, will you be able to give industry more specific guidelines as to reprocessing policy or will it still be based on a mythical plant and this $15,300 a day charge?

Will you get information under this construction that will enable the Commission to put out a more specific reprocessing policy?

Mr. FIELDS. I don't believe we have any plans for a change in the processing determination method.

Representative HOLIFIELD. It is an experiment anyway. You set it up to the best of your judgment?

Mr. FIELDS. Yes, sir.

We still have in mind that if this can be handled by industry, it would be.

Representative HOLIFIELD. But you have had no offers?

Mr. FIELDS. We have had quite a few meetings and discussions with industry. There was the problem of setting processing charges so that the industries building reactors had something firm on which to lay their plans. On the basis of the charges we established, as far as I know, no industry has undertaken to develop a processing facility of this nature. It may well be that they will in time. For that reason partly, I think the charges should stay about where they are.

Representative HOLIFIELD. Can you find out what your actual experience will indicate in the cost? Also, find out whether any private plant will come up and make a better competitive offer.

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. After you construct this plant, it will be your policy, I suppose, to use these plants for the AEC load?

Mr. FIELDS. I would think so; yes, sir.

Representative HOLIFIELD. For the Government load and military appliances and so forth?

Mr. FIELDS. Yes, sir. To the extent we can, we would withdraw from the licensed field in order not to compete with industry if it does go forward.

Representative HOSMER. In the light of what you just said, I would take it that your primary purpose is to get some kind of a cost estimate which you can assure the industry.

Mr. FIELDS. It is a little more than that, Mr. Hosmer. By the time these are built, there will be something like $30 million a year investment in the materials that will come back for reprocessing. There is enriched uranium to be recovered.

Representative HOSMER. That is right. I am just wondering how much it is going to hurt if you put those materials in raw storage for a couple years, delay this project for a couple of years, and use that $15 million on some of these other projects we were looking at for research. We know you can store this stuff.

Mr. FIELDS. If an industrial proposal were to come in, we might wish to contract with them for some of this reprocessing.

Representative HOSMER. That is right. From storage you would have a whole lot to give them to work on.

Mr. FIELDS. In that case, as I believe the analysis sheet indicates, we would like to have the authority to apply this against the contingent liabilities we have when we enter into such contracts.

Representative HOSMER. Waiting a couple of years and putting this stuff in storage, you not only build up enough of the stuff for somebody to get interested in from a private processing standpoint, but you can take the money and put it some place else, can you not?

Mr. BLOCH. Mr. Hosmer, there are some problems in letting any quantity of this accumulate in storage. One of the problems is just providing the storage facilities.

Representative HOSMER. I understand. But the wastes that you extract are going to have to be stored. Your special nuclear materials are not deteriorating to any extent in the process. To my mind that is a specious argument because you are going to have to store it anyway.

Mr. BLOCH. There is a difference, though, sir. If these irradiated fuels start coming back and we have to store them for any length of time, we will have to build cooling basins or hot cells of some kind in which to store them, because they are highly radioactive.

Representative HOSMER. Mr. Fields said you have some canyons out there at Hanford that are not being used that he was going to use for this sort of thing.

Mr. BLOCH. I don't know the extent to which they could act as storage for any significant quantity. Even modifying them for storage of a large quantity would involve some money.

Mr. FIELDS. These elements will come back very hot. We will have real problems in storing them. In addition, our forecasts on the availability of material do contemplate the reprocessing of these and the recovery of enriched materials.

Representative HOLIFIELD. This is one of the main things for processing, to get the plutonium out?

Mr. FIELDS. Yes, sir. There would be another problem if we stored them. Until we process them, we don't know in fact what is there, except on the basis of estimates.

Representative HOSMER. You can analyze laboratory quantities and come up with a fair estimate?

Mr. FIELDS. You can do fairly well, but you don't know what your processing losses are going to be; that is, what may be lost in the actual processing of the materials. These vary considerably, especially when you are getting into new fields like this.

Representative HOSMER. You have done a great deal of processing. You know that. All you are trying to do is to build facilities to get this stuff into solution to run through your present processing plants, are you not?

Mr. FIELDS. I think it is a little more complicated than that.

Representative HOSMER. You are going to pipe it over to the Redox plant? Is that not what you testified?

Mr. FIELDS. That is right.

Representative HOSMER. And run it through the same machinery that the present material is being run through?

Mr. BLOCH. It is a different type of solution and you can expect different results. This is one of the problems that you run into. These different types of fuel elements just do not behave the same.

Mr. FIELDS. One other thing, Mr. Hosmer, is that one of the key elements in the power reactor field is the processing charges. The question is what is the sensible process to use.

Frankly, I think this area needs a great deal of effort and this project would be very helpful.

Representative HOLIFIELD. There is an obligation also to make a specific credit to these different private plants. As they are going to be using different enrichments and exposing the rods for different periods of time to achieve their particular objective, you have to reduce this to a current bookkeeping item in order to handle your fiscal affairs.

Mr. FIELDS. All of these projects take 2 or 3 times as much enriched material in inventory as is in the reactor at any one time. A deferment of the processing means that the inventory is going to be another 2 or 3 times as much. You soon get tied up so that you are using 1,000 or 2,000 kilograms for a reactor when you might be able to use only 200.

Representative HOLIFIELD. Under the present arrangement you are charging them interest for the uranium that is in inventory?

Mr. FIELDS. That is right.

Representative HOLIFIELD. And this is one of the things they are complaining about?

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. What about your construction time period here? Your backup data shows that you can get this done by December 1961 by starting in on July 1. Do you have your designs? Are you ready to start? Can you complete it in that length of time?

Mr. BLOCH. We do not have detailed designs, sir; we are still working on process development. We hope to begin to firm up the processes later this year, with the idea that we could initiate design and construction late in next fiscal year.

Representative HOLIFIELD. Late in 1959 fiscal year?

Mr. BLOCH. Yes, sir. The controlling feature, probably, will be special equipment which has to be fabricated. A long lead time is really required to place orders to get these special vessels fabricated. The actual installation, probably, will not take too long. On the basis of the current outlook, it appears that we may have to be in position

to start taking some of these cores back by the scheduled completion date.

Representative HOLIFIELD. You mean over and above your present processing facilities?

Mr. BLOCH. I am talking of the power-reactor fuels that would begin to come back.

Representative HOLIFIELD. You have excess processing facilities now for the AEC load you are carrying, do you not?

Mr. BLOCH. Yes, sir. That is, for our production load. They are quite different fuels than these, and these modifications are necessary in order to get in shape to handle the special fuel.

Representative HOLIFIELD. What relation does this have to these 3 projects in 1956, D–4, 1957, A–3, and 1958, B–4, which have the following amounts, $2,560,000 in 1956, $5 million in 1957, and $10 million in 1958? Is this a duplication of those amounts?

Have those amounts been spent? What is the relation?

Projects 56–d–4, modifications to separation and processing facilities, Hanford, Wash., $2,560,000. You might comment on that.

Mr. FIELDS. As I recall, there were modifications to the chemical-processing facilities the last 3 years. Those were modifications that were necessary in the processing of production materials.

Mr. BLOCH. That is correct.

Mr. FIELDS. Some of them were for increased efficiencies. I would have to go back and review it, but my recollection, sir, is they were entirely in the chemical-processing facilities, which are rather substantial, as you know, in terms of total capital investment.

Representative HOLIFIELD. You had $15 million at Savannah River in the 2 additional projects, 57–a–3 and 58–b–4, and they are listed as improved high-level waste installations and improvements to supporting installations. So, this is completely different.

Mr. BLOCH. This project is different. On those projects, I could give you more in executive session.

Representative HOLIFIELD. It is not necessary. The point I want to make is that this is not a duplication, and it is a completely different problem.

Mr. BLOCH. Yes.

Representative HOLIFIELD. I think I know what the problem is. I wanted the record to show that it was different. Are there any further questions on this item 59–a–1?

Mr. TOLL. Why is it that this will be done at four different sites?

Is this for ease of transportation?

Why are not all the improvements made at Idaho, for example, and all of these civilian fuel rods processed at one place?

Mr. BLOCH. Because this appears to be the easier and cheapest way of doing the job. For example, Idaho is set up to handle only highly enriched fuels. They do not have a facility where they can recover plutonium, for example. We studied, I guess, a dozen different plans, and this appeared to be the combination that would result in the lowest cost and make maximum utilization of what we have. It is not based on geography. It is based on the type of facilities that we have at those various sites, their availability, and their adaptability to the various problems.

Mr. TOLL. Your backup sheet did not provide much of this information to the committee as to dividing it between the different sites.

If you made these studies and have some indications as to which would be done where, how much money will be spent at each of the four sites, would it be possible to submit this to the committee?

Mr. BLOCH. Yes; we can. It is still preliminary. For the purposes of the work, we have made surveys of the various sites. There could be some shifts before we actually finally firm up what we are going to install. But we could give you a breakdown on the basis of today's tentative planning how this $15 million might be split.

Representative HOLIFIELD. Will you furnish us a breakdown on that?

Mr. BLOCH. Yes, sir.

(The material referred to follows:)

Project 59–a–1. Plant modification for processing of nonproduction spent fuels

Based on our current tentative plans the approximate breakdown of the $15 million by sites is:

	Millions
Hanford, Wash	$9.1
Arco, Idaho	3.5
Savannah River, S. C	2.4
Total	15.0

As mentioned earlier, these estimates are based on current knowledge of the technology required to prepare the various fuels for separation. As more information is obtained on the chemical processing of the fuels and on the composition of fuel elements to be used in the reactors, adjustments in the above costs will probably be made.

Representative HOLIFIELD. The Chair will announce that the question now occurs as to what method we will proceed with on these items. The chairman has suggested to me that, unless there is objection, as a subcommittee we will tentatively approve this item. Of course, the full committee has to pass on it, finally.

If there are any objections, we will hold it out for further discussion. If there is no objection, this will be tentatively approved and referred to the full committee on that basis.

The next item, 59–a–2, pilot plant for fabrication of new fuel elements. Are there any questions on 59–a–2 from the members of the committee?

The staff has prepared these questions. Why is this referred to as a pilot plant? Is there intention to build another, larger plant for this purpose later?

Mr. BLOCH. It is referred to as a pilot plant because the work that will be done is in the developing of processes and production of test lots of fuels. It could be a pilot plant for a full-sized plant, depending on what might develop in the future with respect ot our fuel-element requirements.

Representative HOLIFIELD. Does this demonstrate methods of procedure in the hope that, maybe, private industry will come in and build a larger plant later?

Mr. BLOCH. Sir, this item is associated with our production program.

Chairman DURHAM. It is not one of those that we asked for bids from industry. We did ask for bids for processing plants by industry in the last year.

Mr. FIELDS. In feed materials.

Chairman DURHAM. This is not related to that?

Mr. BLOCH. This is a small pilot plant costing $335,000, to do development work and to produce test quantities of certain fuels which are of interest to the production program.

Mr. FIELDS. It would be a part of the Fernald feed-materials plant.

Mr. BLOCH. That is right. It would be built at Fernald.

Representative Holifield. There are 2 items in the budget requests for a metals process development plant at Ames, Iowa, for $1,900,000, and a metal and ceramics research building, ORNL, $6,500,000.

These were stricken by the Budget, were they not?

Mr. FIELDS. Yes, sir. They did not come forward to the Congress

Representative HOLIFIELD. Is there any relation?

Mr. FIELDS. There is no relationship between these projects, sir.

Representative HOLIFIELD. Can you provide more details for an executive session on this matter?

Mr. FIELDS. We could.

Mr. RAMEY. This metals process plant at Ames is not a classified matter, is it?

Representative HOLIFIELD. I am not talking about that.

Mr. FIELDS. He was asking about this pilot plant.

Mr. BLOCH. I can say that this pilot plant is essentially piloting fabrication processes. It is not involved in basic metallurgy.

Mr. FIELDS. It is an application of processes at Fernald itself.

Representative HOLIFIELD. Why do you ask for a 25 percent override in this?

Mr. FIELDS. There are a number of projects, and this is of that nature, which involve new processes and new kinds of equipment and have a greater element of uncertainty than others, buildings for example. We have found in the past that the area of this uncertainty is in the amount of 25 percent and it seemed prudent that this project have that flexibility.

Mr. TOLL. Mr. Fields, it says that this project provides for the construction of a building and necessary equipment. That is the question. Why is the 25 percent flexibility needed when this is for a building?

Mr. FIELDS. About half of it is equipment, Mr. Toll.

Mr. BLOCH. About half of it is equipment. The estimate is not based on detailed engineering. Until you have had engineering, and until you have quotations on equipment and have finally nailed down the specific kinds of equipment you need, you do need some flexibility.

Representative HOLIFIELD. Are there any other questions on this item? If not, it will stand tentatively approved.

59–a–3, reduction in fire hazards—phase II, gaseous diffusion plants.

Mr. BLOCH. This is a project totaling $11,900,000 to complete the work necessary for reduction of fire hazards at our gaseous diffusion plants at Oak Ridge, Paducah, and Portsmouth.

The committee will recall that last year we asked for a $12 million item to initiate this work. As I recall, we indicated that studies were still underway and we did not have a very clear idea at that time as to what the ultimate scope and cost would be. We have completed studies with various companies who have had experience in this type of a fire problem, and the total job now requires an additional $11,900,000.

Representative HOLIFIELD. This brings your total up to what—about $24 million?

Mr. BLOCH. This brings the total up to about $27 million. The estimated cost of the 1958 project has been increased from $12 million to $15 million.

Representative HOLIFIELD. Is this adding additional protection, rather than a raise in the overall project that you are carrying out?

Mr. BLOCH. I do not know whether you would define it as additional protection. When we were up here last year our preliminary study indicated the need for provision of sprinklers to the roofs of these buildings. By the time more details were completed, it became quite evident that to provide adequate protection we also had to provide sprinklers to the ceilings of all the floors in the buildings.

The major change, as opposed to our original thinking, has been the fact that the total areas for which we require sprinkling are now more than double what we had anticipated a year ago.

In addition we are having to do more extensive work on the water supply systems to assure an adequate supply of water. This is particularly true at Oak Ridge, where a part of our water distribution system was put in during the war.

While hydraulic tests are not completed, thus far they indicate that we are going to have to beef up the water distribution system.

I think it is just the fact that we did not have, as of a year ago, a clear concept of what was required.

Chairman DURHAM. Was it not considered that we should do that at the beginning when we built those diffusion plants?

As I recall, the question came up as to the tremendous cost of them and very little protection from fire hazard.

I know we raised the question after visiting the first one we built.

Mr. FIELDS. It could be. About a year and a half ago there was quite an extensive fire at General Motors plant which had these kinds of roofs. We had a fire at Paducah ourselves that was very troublesome. The k-25 and k-27 buildings at Oak Ridge were built during the war. With these kinds of developments there were some hazards that had not been anticipated.

Representative HOLIFIELD. This committee approved the principle of putting in fire protection.

Mr. FIELDS. It certainly did.

Representative HOLIFIELD. Can you give for the record at this time the approximate capital investment this is supposed to project?

Mr. FIELDS. Yes, sir.

Mr. BLOCH. The actual investment in these facilities is about $2,400 million. As of today it probably would cost in excess of $3 billion to replace them.

Representative HOLIFIELD. The principle has been approved. The only question is on the increase in amount but if you have twice as much work to do and your studies and surveys show it, I presume that the committee is justified in giving tentative approval to this item, unless there is objection.

Chairman DURHAM. It would take about 4 years to reconstruct them and put them in operation.

Mr. BLOCH. Yes, sir, it would.

Representative HOLIFIELD. Let us go to 59–a–4.

Mr. BLOCH. 59–a–4 is an item of $3,200,000 for additional waste facilities at Arco. Our current program at Arco indicates that we will need additional waste storage capacity for zirconium-type fuels within about a year and a half to 2 years. This project is essentially to permit us to increase our waste storage capability in anticipation of the requirements that will be on it.

As presently visualized, the estimate is based upon a 300,000-gallon stainless steel storage tank with necessary cooling coils, water supply to provide the cooling, and other auxiliaries.

Representative HOLIFIELD. You requested $6 million for this project and the Budget Bureau cut you down to $3,200,000. What was the basis for the reduction and did the AEC consent to that reduction?

Mr. BLOCH. Yes, sir, we did. The reasons are some that I would have to give in executive session. It has to do with some rescheduling that we ourselves have initiated in connection with certain of our loads.

Representative HOLIFIELD. Project 58–f–1 last year was for waste storage tanks at Arco. That had $3,700,000 attached to it.

Mr. BLOCH. As I recall, those were tanks for waste from aluminum fuel elements and those tanks are currently under construction, sir.

Representative HOLIFIELD. That project was under reactor development and this one is under special nuclear material. Is there any reason for that change in classification?

Mr. BLOCH. The bulk of the work that plant is doing, and will be doing in connection with these new type fuel elements, is in the Production Division's area of responsibility, so we are budgeting for it under the Production Division. There is no duplication. It is simply a transfer of the basic responsibility for scheduling and operation of this plant.

Representative HOLIFIELD. You asked for three 300,000 gallon cooled tanks and one 300,000 gallon uncooled tank last year in project 58–f–1. Our latest estimate for this project is $2,900,000. Apparently you are able to do that a little cheaper than you thought, and have these reductions been taken into consideration in estimating your amount for this year's request?

Mr. BLOCH. I will have to check this but my recollection is that only two tanks are being constructed under the 58 item. That is, two 300,000 gallon storage tanks.

I will have to check that and furnish the information.

Representative HOLIFIELD. Will you furnish us the information on that?

Mr. BLOCH. Yes, sir.

(The information referred to follows:)

Project 59–a–4

Project 58–f–1 provided for four waste storage tanks for uranium aluminum wastes. The cost of this project was reduced to $2.9 million as a result of reprograming the AEC processing program mentioned previously in the discussion of project 59–a–1.

From project 58–f–1 funds (now estimated as $2.9 million) we will construct 2 waste tanks to handle high activity waste for dissolving uranium aluminum fuels, estimated to cost $2.1 million and install a waste transfer system, estimated to cost $0.8 million, which system will provide a means of transferring wastes from any one of the waste tanks, in case leakage should occur, into any of the other tanks having spare capacity.

Representative HOLIFIELD. How many tanks are you planning in this project?

Mr. BLOCH. Our tentative planning is for one tank of 300,000 gallon capacity. However, we might split this into two tanks, the reason being that our policy at Arco is to provide a spare tank in the event we should have a leak in any of the tanks that are full or partially filled. So, depending on our experience as far as containment of this tankage goes and the need for having reserve storage, we might possibly split this into two tanks.

The preliminary estimate is based upon one tank which would be a heavy stainless steel tank.

Mr. TOLL. Mr. Bloch, the breakdown here says waste tanks, $1,165,000. In view of your experience with last year's project, since you said that may be 1 tank or maybe 2, can you tell us about how much a tank costs ordinarily?

Mr. BLOCH. The tanks which we are currently building and which are for the aluminum wastes, are costing around $3 a gallon. As I recall they are about a quarter-inch stainless steel tanks. These proposed tanks are for zirconium-type wastes and we do not have much experience with these wastes.

We have several small storage tanks out there with the first material having gone into them not too long ago.

This estimate is based on the fact that it may be necessary to go to stainless steel almost 1 inch thick for these types of wastes.

Representative HOLIFIELD. Because of the corrosive element?

Mr. BLOCH. That is right, sir.

We hope to reduce the cost. But if we have to go to something almost an inch thick, it will cost a lot more than the $3 a gallon which is the current cost for aluminum fuel waste tanks.

Representative HOLIFIELD. You say your technical data is not available yet on this point. This makes your construction schedule unrealistic, does it not? You cannot start this on July 1, 1958, can you?

Mr. BLOCH. We can start engineering. I have forgotten what the schedule is for starting construction. We would not start July 1, 1958. I think we would start later this year, probably around the end of the calendar year.

Representative HOLIFIELD. You would start in the 1959 fiscal year?

Mr. BLOCH. Yes, sir. Based on what we know today we would have to be conservative and put in these heavy tanks with the heavy link. But we are doing additional development work out there and if within the next few months it indicates that we can get by with something cheaper we would put that in.

Mr. FIELDS. You anticipate proceeding in fiscal 1959.

Mr. BLOCH. Yes, sir. We will have to do that.

Representative HOLIFIELD. Are waste disposal facilities needed at any other AEC installation?

Mr. BLOCH. We have prior year projects which will permit us to put in facilities at Hanford and Savannah River when they are needed. Our procedure has been to have the funds and the authority so that we can move in whenever we have to but to delay actual construction as long as we can. We have made progress in reducing our waste volumes at production sites so that we have been able to delay the installation of tanks for quite a few years in some instances. We build them only as it becomes clearly evident that they are needed.

Mr. FIELDS. I believe this is the only project in 1959 for waste disposal facilities.

Representative HOLIFIELD. As you know, we plan to have more extensive hearings on this matter later but we thought we ought to get these questions in for the record.

If there are no further questions on this, we will tentatively approve it and go to 59–b–1, weapons production and development plants, locations are undetermined as yet. The cost is $10 million.

Mr. FIELDS. Mr. Chairman, as indicated to Mr. Ramey, General Starbird unfortunately had to attend a meeting in Washington and will be here this afternoon. I believe that between myself and Mr. Anthony, who is the budget officer for the Division of Military Application, we can cover these projects. This item is a contingency item in the amount of $10 million. We have had similar items in the budgets for, I believe, the last 3 years.

The rapid developments resulting from research and development and from tests, and particularly now that there are two complete weapons laboratories in operation, Livermore and Los Alamos, lead constantly to changes in designs of weapons and to new weapons.

In order to make the production process flexible, to take advantage of developments, and to provide for all special purpose equipment and plant that are required, it has been necessary to have this kind of authority available to the Commission. It enables us to move quickly.

This has been true in the past. We have fully expended the moneys that have been authorized for this kind of facilities.

We see no less need for this kind of a flexibility in the forthcoming fiscal year with the possible changes coming out of the very extensive tests and development that have been going on.

Chairman DURHAM. This is a kind of emergency authorization.

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. We notice your authorizations have overrun 1956 by 33⅓ percent, about 20 percent in 1957. I assume that this being a blind figure we will be faced with an overrun here, too.

Mr. FIELDS. We hope not, but that is always a possibility.

Representative HOLIFIELD. We will pass this item over as it has to have executive session consideration anyway.

Mr. FIELDS. Yes, sir, practically all of these do.

Representative HOLIFIELD. We will pass that over without action. 59–b–2, component fabrication plant at Hanford, $3,500,000.

Mr. FIELDS. This is a component fabrication plant. We really cannot say much more here than what is in the analysis sheet. It is to go forward at Hanford.

This is a specific requirement which we could delineate as we send the budget forward rather than have it included in the $10 million contingency item.

Chairman DURHAM. It does deal directly with the weapons development program?

Mr. FIELDS. Not the development program, Mr. Durham, but the production program. The same thing is true of the next item, 59–b–3, a fabrication plant at Oak Ridge, Tenn., in the amount of $12½ million.

Representative HOLIFIELD. We will pass over that. Now, on the mound laboratory plant, 59–b–4, special processing plant.

Mr. FIELDS. Here again is a special processing plant necessitated as developments have gone forward; 59–c–1 is the modifications at the various storage sites.

You are aware of the number of storage sites we have.

This project is for miscellaneous work, some utilities work, and largely some work in the area of fire protection.

Representative HOLIFIELD. Can you give a more specific estimate than this in view of the fact that you are dealing there mostly with roads and fire alarms and sprinkler systems. Have you got a detailed breakdown of that?

Mr. FIELDS. I think we could provide one for the record.

(The information referred to follows:)

59–c–1. Storage site modifications, $1,500,000

Supplementary data on types of modifications planned for accomplishment under this project.

1. Major improvements to service road system (1 site)	$580,000
2. Replacement of floors in storage vaults and loading areas (several sites)	168,000
3. Additional water storage tanks (2 sites)	250,000
4. Resurface patrol roads (several sites)	150,000
5. Installation of water demineralization facilities (1 site)	100,000
6. Additions to fire stations, installation of improved fire alarm systems and automatic sprinkler systems (several sites)	172,000
7. Additions to storage structures	80,000
Total	1,500,000

Representative HOLIFIELD. We will tentatively approve this item, then 59–c–2 base construction, Eniwetok Proving Ground.

Mr. FIELDS. This item, sir, is for construction there. A good part of it is for construction in the area of hangars and airfield improvements in order to service the type of aircraft that are necessary in the operations in the Pacific in conjunction with the Pacific tests. Some of it is for rehabilitation of the petroleum, oil and lubricant facilities that have been there for a long time and are deteriorating somewhat. It would also provide some offshore pipeline to service the Eniwetok Proving Ground.

Chairman DURHAM. This is AEC-controlled and owned?

Mr. FIELDS. Yes, sir. The proving ground there is maintained and operated by the AEC, Mr. Durham. All of the construction is budgeted by the AEC.

Chairman DURHAM. You have control over it?

Mr. FIELDS. Except for certain specific military items such as barracks, etc. We do support the entire proving ground area.

Chairman DURHAM. That is why I am posing the question because of the fact that we are faced with a $600 million public works bill over in the Armed Services Committee.

In going over the items, I am worried somewhat about the duplication in some of these projects coming in from the two establishments. I say I do not know whether it is in your area.

Mr. FIELDS. We have an agreement with the Department of Defense which provides that we build all the facilities and utilities, and operate the proving ground, including the test sites, as well as the support facilities.

Chairman DURHAM. You do not have made available to you the construction items in the public works bill to see whether or not there is duplication?

Mr. FIELDS. I do not believe we have done that. We could, I presume, very easily.

Chairman DURHAM. I do not see why we should not do that because I have been worried for some time about this.

Mr. FIELDS. I am not aware that there is a project in that bill for this area.

Chairman DURHAM. I suppose under this new reorganization plan which we are getting, which seems to solve all the problems of duplication—at least it has been advocated that it will—that we may get some results in this field of operations.

Mr. FIELDS. I do not recall that the military departments have ever budgeted much for Eniwetok.

Chairman DURHAM. They have gotten into the reactor field and everything else.

Mr. FIELDS. Of course, they do have large operating expenditures during the course of a test operation.

Chairman DURHAM. I do not ask you to do anything except to take a look at it and assure this committee that we are not duplicating items.

Mr. FIELDS. We will do that, Mr. Durham.

Representative HOLIFIELD. This item will be tentatively approved. 59–c–3, base construction at the Nevada test site. We have gone over that before in executive session.

Is there any particular question on that?

Mr. FIELDS. Mr. Chairman, the next item, 59–c–4, is test area development at the Nevada test site. It has been our practice to ask for authorization before we develop a new area. This is specifically for the purpose of developing an underground shot area. We used temporary roads and strung temporary power lines for the Ranier shot.

We do believe we should look extensively at underground testing and this project is to provide a permanent test area.

Chairman DURHAM. You have reached the conclusion that this should be made permanent?

Mr. FIELDS. We are going to make that area a permanent test area.

Representative HOLIFIELD. Of course, all of these testing developments would be modified if a bona fide test banning agreement was reached.

Mr. FIELDS. This authority would not be applied, obviously, if there was a change of that nature. However, there might be some problems of standby which would be involved.

Representative HOLIFIELD. If there is no objection, this will be tentatively approved.

Mr. FIELDS. 59–c–5 is a diagnostic test site for Los Alamos on certain components and involves a reinforced concrete structure that is shockproof. It includes about a million dollars' worth of buildings and three quarters of a million dollars' worth of equipment.

You recall Los Alamos has what they term outlying sites which are bunkered in many cases so that they can conduct the tests with the components that are involved. This is a facility which will be very helpful in the research at Los Alamos.

Chairman DURHAM. What is the improvement in land? Is that roads?

Mr. FIELDS. Yes, sir; this is roads on the present site at Los Alamos.

Representative HOLIFIELD. If there is no objection, it will be tentatively approved.

We will go to 59–c–6, laboratory building, TA–33, Los Alamos.

Mr. FIELDS. This is to provide a laboratory building for certain Los Alamos personnel in one of the outlying site areas. This group has been working in that area for some time and have been housed in the present new administration building which is quite remote from the test site area. It would greatly facilitate their work, and the work they are doing is quite important, Mr. Chairman, if this construction could take place at the TA–33 site at Los Alamos.

Chairman DURHAM. Is this absolutely necessary? You have been carrying on the work?

Mr. FIELDS. It has been carried on inefficiently, I would say, Mr. Durham.

Chairman DURHAM. What is the travel distance involved there?

Mr. FIELDS. It is is nearly 20 miles, I have been informed. It is 20 miles back and forth. One of the problems is that the kind of thing we have to do, and I cannot describe it in open session, just cannot be done efficiently in the main laboratory building at Los Alamos. These people were originally housed in the temporary buildings.

Representative HOLIFIELD. You look upon this as more important than the laboratory and engineering building items which the Bureau of the Budget has deferred?

Mr. FIELDS. It is more important to the weapons program. Whether it is in the overall, I do not know.

The next item 59–c–7, is for environmental testing installations at the Sandia Base, and page 20 of the analysis lists the different types of testing facilities which are necessary.

In all the weapons we look towards quality and maintenance of standards so that they will hold up in the environments to which they are exposed.

We are getting into areas now, and will more so in the future which deal with warheads for missiles. It is quite essential that these things be tested in the environments which they will experience.

It is a question of determining the reliability of the components we develop and design and how they will take the kind of environment to which they will be exposed.

Chairman DURHAM. Here is where I am afraid you are getting into the duplication field, because all the services are carrying out this type of work.

Mr. FIELDS. They are carrying out some of this kind of work, Mr. Durham, but they are not doing it on the things we design and build.

I think this project is necessary in order that work can be done expeditiously and properly and under the control of the Sandia Corp., who have extensive development facilities, as you know, at Sandia Base.

Representative HOLIFIELD. This is really in the field of testing very delicate components?

Mr. FIELDS. Yes. You take a gadget with a lot of relays in it. You have to see how they bounce and how they lift.

Representative HOLIFIELD. How they perform under vibration.

Mr. FIELDS. Yes, sir.

If the relays are electrical, which they are quite often, you must understand how they operate in vacuum or lack of vacuum.

Chairman DURHAM. I hope all of this information is passed on to the military because it is important to them.

Mr. FIELDS. It is passed on to them in the form of reliable components. It is also included in the handbooks in which we set forth in detail their uses and their limitations.

We work very closely with the Armed Forces Special Weapons Project at Albuquerque in all the actual proving in of these things. AFSWP is represented on the Weapons Board which sits and looks at these developments and determines the full scope of the testing to be done before something can be approved to enter stockpile.

Representative HOLIFIELD. All right. 59–c–8, linear accelerator tester. We know what that is.

Mr. FIELDS. This is the same sort of facility, except it is at Livermore. It is for a particular kind of thing that they need for testing. It is to test under the several field-use conditions that will obtain when these are put into the stockpile.

Representative HOLIFIELD. 59–c–9, test assembly building. That is along the same line, is it not?

Mr. FIELDS. This assembly building is slightly different, but I believe it is described as fully as I can in an open session.

Representative HOLIFIELD. We will pass over that to execute session.

Mr. FIELDS. It is essential, I would say, in the testing of these components.

Representative HOLIFIELD. 59–c–10, high explosive development plant.

Mr. FIELDS. This project is for provision of certain additional facilities for the Livermore laboratory at their site 300. They have a site, as you know, 15 miles from Livermore for testing and development of the high explosives which are used in weapons components. This project is for certain additions, including buildings and equipment, so that they can do the kind of forward research that would, we hope, lead to improvements in the weapons.

Representative HOLIFIELD. Are there any further questions?

If not, will you proceed?

Mr. FIELDS. The last, 59–c–11, is to provide some storage and handling space at Livermore itself.

Representative HOLIFIELD. This is to replace some of those old barracks buildings?

Mr. FIELDS. Yes, sir. You have been there, and you are aware of the old barracks buildings that were used when we first established that laboratory. They were used effectively. But because of their design and limitations in space and height, we believe it would be very helpful to go forward with this kind of a facility.

Representative HOLIFIELD. You have a pretty valuable inventory to be stored in these buildings.

Mr. FIELDS. Yes. I do not have the figure in mind myself, but I believe we could supply that for the record.

(The information referred to follows:)

59–c–11. Storage and handling building, Livermore, Calif., $250,000

The present value of materials stored in the old barracks is $415,000. It is anticipated the value of materials required and to be housed in the new facility will be about $700,000.

Representative HOLIFIELD. You are going to tear down the old barracks, I suppose?

Mr. ANTHONY. Yes, sir.

Representative HOLIFIELD. I notice that this estimate was made over a year ago. Does your cost estimate still stand firm?

Mr. ANTHONY. Based on recent bids we have gotten in the area, I would say it does.

Representative HOLIFIELD. Are there any further questions? If not, 59–d–1, reprocessing pilot plant.

We are getting into reactors. This is the military reactor?

Mr. FIELDS. No; it is related to hooking together three facilities at Oak Ridge to do work on fuel reprocessing on a laboratory basis. I think that and the next few could be handled, if you wish, Mr. Chairman. They do not deal too directly on the civilian power.

Representative HOLIFIELD. The next two.

Mr. FIELDS. The next six items, I believe. In other words, items d–1 through 6. I will ask Mr. Davis to come forward and speak to these.

Representative HOLIFIELD. All right.

Mr. Davis, starting in with 59–d–1, we have backup on all of these, and going through 59–d–6, you might take them in order if there is anything in particular you want to add to the backup material or if you wish to summarize it at this time.

If there are any questions, members can stop you at any point.

Representative HOSMER. Mr. Chairman, if he would relate this 59–d–1 to 59–a–1.

Mr. DAVIS. Yes. There is a very close relationship. The division of interest here between the Production Division and the Reactor Development Division is that we are concerning ourselves primarily with the development of new processes, particularly for the power reactor fuel elements and for some of the military reactor fuel elements and the Production Division is concerning itself with the actual scheduled processing of these materials.

The project 59–d–1 is a project to tie together and add to some of the facilities now existing at Oak Ridge, and to provide a general-purpose development plant where a number of these processes for various types of fuel elements can be tried out on a pilot-plant scale.

Some of this development work in turn will be used in the alterations made at the production plants by the Production Division and some of these processes would presumably ultimately be used in terms of industrial methods for carrying out the processing more cheaply.

This facility, when it is completed, would also be able to handle some of the materials coming back from some of the power reactors. It is not a large capacity facility but will take care of some of the items, particularly some of the specialized ones such as the thorium-uranium mixtures that may come from a couple of the reactors.

Chairman DURHAM. You do not think it is possible for us to get private enterprise to take over this job at the present time?

Mr. DAVIS. I do not think they will in the development aspects and in particular that they would want to build a small scale pilot plant of this sort.

The question, incidentally, of the industrial processing really revolves around the volume of the material. As you recall, the hypo-

thetical plant on which the charges are based is about a ton a day. This plant is about a third of a ton a day at the maximum.

I believe the industrial people know that you need an assured volume of something well over a ton a day before they would start to become interested. This is really a pilot plant and our hypothetical plant was certainly on the lower edge of what industry would consider as an acceptable volume.

Representative HOSMER. Could it be combined with this other project and reduce the total cost?

Mr. DAVIS. No, sir. The other project did not include this work being done at Oak Ridge, so that the total cost would remain the same even if the two projects were combined.

Representative HOLIFIELD. Then you would have your problem of transportation.

Mr. DAVIS. Here we already have a considerable number of facilities of a developmental nature already in existence. This project will permit tying them together, adding some new head-end facilities and operating as an overall unit, and, incidentally, supplying feed material to the fission product recovery plant, to furnish them with materials to operate on to demonstrate the recovery of specific fission products.

Chairman DURHAM. You have the personnel at those places that can do the same type of work?

Mr. DAVIS. There is a very good group at Oak Ridge who are doing this development process work.

Chairman DURHAM. The other place is the same?

Mr. DAVIS. The other places have groups; yes, sir.

Mr. FIELDS. Mr. Hosmer, if you go back into the history of the project you will find that the big separations plants built at Hanford and Savannah River have been based on research and development work on the solvent extraction process which was done at Argonne. Oak Ridge, I believe, did the research and development work on the Thorex process. It is in the laboratories that the chemistry and metallurgy work in these very new areas is first done to lay out what you can do basically.

Then it is transferred to the large plants themselves for the design of actual processing equipment.

Representative HOSMER. That is what I thought. That is why I am confused that you have the large plant and the pilot plant where you are going to find how to build it in the same authorization request. There must be a time difference if what you say is true.

Mr. DAVIS. There will be some time difference in that this plant is scheduled to begin construction this summer and to be completed by the end of next calendar year.

Not all of the things which are developed in this plant will find use in the alterations that are being made under the Production Division project.

Representative HOLIFIELD. This is mostly for laboratory work?

Mr. DAVIS. This is for pilot scale work.

Representative HOLIFIELD. Pilot scale work on laboratory experimental materials.

Mr. DAVIS. Actual production runs through a pilot plant scale with hot materials from some of the reactors.

Representative HOLIFIELD. A very small plant in consideration of this other plant you are talking about.

Mr. DAVIS. Compared with the full-sized industrial plant this would be something like perhaps 10 percent of the size.

Representative HOSMER. You are going to do a half ton a day here?

Mr. DAVIS. Less than that. It will be about 300 kilograms maximum.

Representative HOSMER. Fifteen tons a day, that is 30 percent capacity.

Mr. DAVIS. It would be about a third of the nominal 1 ton a day plant and, assuming that a commercial plant might be 2 or 3 tons a day, this would be something like 10 percent of that.

Mr. FIELDS. Mr. Chairman, I do not want my previous remark to be construed to imply that Hanford and Savannah River have not done a great deal with the separations plants they have so effectively operated. They have done a wonderful job.

The laboratories get into the area of new development, research, and processing.

Representative HOLIFIELD. The point is particularly some of these new fuel elements that will be used in commercial reactors.

Mr. DAVIS. Yes, sir. Zirconium-clad fuels, stainless-steel-clad fuels, and things of this sort.

Representative HOLIFIELD. The next is 59–d–2, special purpose test installation.

Mr. DAVIS. 59–d–2 is a project which is connected with one of the military programs—the Snap program—and is for essentially test cells to carry out various tests of these power units.

Representative HOLIFIELD. We will take more on that in executive session. 59–d–3, fast reactor safety test station at the Nevada test site.

Mr. DAVIS. This is a project which provides the general facilities which would support tests of cores of fast reactors. The scope of this is primarily to provide the facilities, the roads, the control facilities, utilities, and so on which would go with the testing. It does not provide the facilities which will be tested themselves.

This is in connection with the fast reactor program. It is being carried out primarily by Los Alamos, with some support from the Argonne National Laboratory.

The intent here is to carry out much the same types of tests we have carried out with the water-cooled reactors in the facilities at Idaho.

Representative HOLIFIELD. I notice you have quite a cutback on that from what you have requested. It is more than half.

Mr. DAVIS. Yes, sir. This is due to our decision that we needed at this time only to provide the facilities necessary for carrying out the tests and that we would not need to provide the things to be tested at the present time.

Representative HOLIFIELD. This is some of the early work that you are going to have to do in order to prove the safety of some of these factors that are involved in reactors such as the PRDC reactor?

Mr. DAVIS. The results here would be of considerable interest to anyone building fast reactors.

As you know, in the so-called Spert series of tests at Idaho we have been able to find out about the behavior of heterogeneous cooled reactor cores.

Our objective is not to try to destroy reactor cores but simply by building a variety of small-scale reactor cores and subjecting them to various conditions, to try to find out how they behave.

This has been a very profitable line of development so far.

We feel we are beginning to understand the water-cooled reactors in this respect, and this type of facility will give us the same basic kind of information on the sodium-cooled fast reactors.

Representative HOLIFIELD. Are there any further questions on that? If not, we will pass along to 59–d–4.

Mr. DAVIS. This is the Army reactor experimental area at Arco, the Army group in the division is currently constructing 2 reactor experiments at the site and has plans for possibly 4 more.

We believe it is necessary to provide a facility here, which is the largest item, and the hot cells and equipment coming out of these experiments.

Representative HOLIFIELD. Any further questions? If not, 59–d–5, hot cells.

Let us go back to 59–d–4. Mr. Toll has a question.

Mr. TOLL. There was an item originally requested in your budget for Army package power reactors, Department of Defense small plant reactors, of $30 million, and subsequently removed. I see part of the justification of this items says that it is probable that 4 more Army power reactors will be located in the general area of the National Reactor Testing Station by 1965.

If this project is being cut back or deferred by the Bureau of the Budget, does that cut down on your justification for this project?

Mr. DAVIS. No, sir. This is connected entirely with development type reactors. The other project was concerned with the use of the reactors in the field.

Mr. TOLL. You still believe there will be 4 more Army power reactors in the general area of Arco?

Mr. DAVIS. This is our present planning. I do not think it can be said at this time whether it is 2 or 3 or 4 or 5.

Representative HOLIFIELD. You are asking for them?

Mr. DAVIS. Not at this time.

Representative HOLIFIELD. They were included in the $30 million that was deferred?

Mr. DAVIS. Not those reactors. The other reactors that were covered by the $30 million are items with reactors to be at the field location, and not specifically as developmental reactors.

Representative HOLIFIELD. Actual use reactors?

Mr. DAVIS. First field generation of reactors.

Mr. FIELDS. I believe there are two there now.

Mr. DAVIS. There are two at Idaho, the Argonne low-powered reactor and the gas-cooled reactor experiment.

Mr. TOLL. If your field requirements are being cut back or deferred, does this affect the development program?

Mr. DAVIS. I do not believe so; no.

Representative HOLIFIELD. We hope it will not. The next one is 59–d–5, hot cells.

Mr. DAVIS. This is a project somewhat similar to the one we had in 1958 for provision of hot cell facilities at various AEC laboratories.

As you know, we are almost always in very severe shortage of hot cell facilities for various types of work and this type of an authorization has allowed us to meet the most urgent needs in the previous year.

There is a very continuing need and there were quite a lot of requirements developed last year that we feel must be met this year.

Representative HOLIFIELD. You have a backlog of hot cell demand that you have not been able to satisfy?

Mr. DAVIS. That is correct.

Representative HOLIFIELD. What is this 59–d–6, Army package power reactor No. 2?

Mr. DAVIS. This is basically an improved version of the APPR–1. It is intended not only to be somewhat of a developmental reactor but to be the next step in the APPR–1 type of reactor leading toward the field use of these reactors.

Representative HOLIFIELD. Breaking it down into assemblies that can be transported by air?

Mr. DAVIS. Yes, sir.

Chairman DURHAM. Did they not get authorization last year for that work?

Mr. FIELDS. I believe we did, Mr. Durham, the year before.

Chairman DURHAM. Somebody got it.

Mr. FIELDS. About 3 years ago we got authorization. It was 2 or 3 years ago. I would have to check. (NOTE.—The APPR–1 was authorized in 1955 under authority available to the Commission prior to enactment of the Atomic Energy Act of 1954.)

Mr. DAVIS. The APPR–1 was funded partially by the Commission and partly by the Army.

Chairman DURHAM. There is no use of one agency getting funds and the other agency not getting the funds because it is a joint project.

Mr. DAVIS. Yes, sir.

Representative PRICE. Is APPR–1 at Fort Belvoir?

Mr. DAVIS. It was partially supported by the Army and partially by the AEC.

Representative PRICE. Do they still call it a "package" reactor?

Mr. DAVIS. Yes, sir.

Representative PRICE. It is quite a package.

Mr. DAVIS. The problem is to take them there in packages. It is a problem of being able to disassemble them and move somewhere else in packages.

Representative PRICE. What could they disassemble in the Fort Belvoir plant?

Mr. DAVIS. I think it would be possible in all probability to remove most of the primary loop equipment and actually move it.

Representative HOLIFIELD. That is what you are going to try to do in this project, to try to learn to break it down?

Representative PRICE. That is what they were doing in APPR–1.

Representative HOLIFIELD. Has not the Martin Co. done that?

Representative PRICE. They have plans for doing it. Is that what the Army is thinking of here, the Martin proposal?

Mr. DAVIS. No; not specifically.

Representative HOLIFIELD. Let us pass this over and look at it in executive session.

You do not have any site picked for this or anything like that right now?

Mr. DAVIS. No, sir, not at the present time.

Representative HOLIFIELD. We will look at it in executive session.

Mr. FIELDS. You may wish to move forward to other items now, Mr. Chairman.

Representative HOLIFIELD. We are going to move forward to lunch pretty soon.

We will reassemble here at 2 o'clock.

AFTERNOON SESSION

Representative HOLIFIELD. The committee will be in order.

Let us skip over the following items, 7, 8, 9, 10, and 11 for the present and start in with the physical research section, project 59–e–1.

STATEMENTS OF K. E. FIELDS, GENERAL MANAGER, DON BURROWS, CONTROLLER; FRANK McCARTHY, ASSISTANT CONTROLLER FOR BUDGETS; L. OLSON, GENERAL COUNSEL; W. K. DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; DR. J. H. WILLIAMS, DIRECTOR, DIVISION OF RESEARCH; JOHN A. HALL AND DR. JESSE D. PERKINSON, OF THE DIVISION OF INTERNATIONAL AFFAIRS; DR. P. W. McDANIEL, DEPUTY DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; E. J. BLOCH, DIRECTOR, DIVISION OF PRODUCTION; FRANK K. PITTMAN, OFFICE OF INDUSTRIAL DEVELOPMENT; ED DIAMOND, ASSISTANT GENERAL COUNSEL; AND DAVE ANTHONY, BUDGET OFFICER FOR THE DIVISION OF MILITARY APPLICATION—Resumed

Mr. FIELDS. Mr. Chairman, there was some discussion of item 59–e–11 which is the project Sherwood plant. This one project was the item I referred to previously when we were discussing the 1958 Sherwood item. This is project 59–e–11.

Representative HOLIFIELD. Very well.

Mr. FIELDS. This project is for an authorization in the amount of $2 million to provide for construction of supporting installations at several sites in the event of new developments in the Sherwood program during the year.

This is for supporting facilities only.

Representative HOLIFIELD. This is not classified material, is it, to explain what this project is?

Mr. FIELDS. No, sir.

Representative HOLIFIELD. And how long have we been working on this?

Mr. WILLIAMS. As far as I know, sir, the project began in a limited way in 1954.

Mr. FIELDS. It may have been a little earlier than that.

Mr. WILLIAMS. It was built up so that there are four major laboratories now. The Oak Ridge National Laboratory, Los Alamos Scientific Laboratory, the big activity at Princeton, and an activity at the Livermore Laboratory of the University of California.

There are several smaller projects on associated minor problems.

The work has gone along and the purpose of the work is to try to produce the controlled thermonuclear reaction in which energy is released by the fusion of light nuclei with the ultimate goal of producing power on an economic basis.

The materials so far are being declassified to a reasonable extent.

It is the plan of the United States to disclose a great deal of their progress at the forthcoming Geneva Conference in September.

At that time we anticipate, on the basis of some abstracts, some revelations of how the Russian program is going.

That is one reason for having such a contingency. This is really a sort of freedom to move item, that we feel to be important at this time.

Representative HOLIFIELD. Do I understand that it will be contingent upon Russian disclosure that we would make disclosure?

Mr. WILLIAMS. No.

Representative HOLIFIELD. I would hope not.

Mr. WILLIAMS. Not at all. This is an example of one of the things. We may get some breakthroughs in our own program which we do not know about now. We will have to push forward on every promising example.

Representative HOLIFIELD. You may remember it was Dr. Bhabha's disclosure in the Geneva Conference that caused the hurried disclosure of the fact that we had been working in this field, which had hitherto been classified.

It is well to know that we have had items of appropriation for the past 3 years in the thermonuclear research area. Although we had not disclosed it, this field has had attention.

Are there any particular questions on this from any of the members?

If not, we will go to 59–e–1, page 4, physical research. This is for improvements to the accelerator at the University of California Radiation Laboratory.

Mr. WILLIAMS. These items are to provide funds so that one may improve the utility and versatility and the effectiveness of these research instruments at the radiation laboratory.

They are in general the provision of further shielding, large magneto extract beams, detection equipment, and the general improvement of the facilities attached to and around these accelerators so that the progress can be made in terms of what has already been done during the last year on the nature of the problems being worked on.

Representative HOLIFIELD. There is no way of increasing the number of experiments on this machine; is there?

Mr. WILLIAMS. This is a very tight scheduling business. By further extraction mechanisms one can sometimes improve the utility, having 2 or 3 experiments going on at the same time by switching the beam between pulses and things of that sort. It is this sort of support that allows for more effective use of the machine.

Representative HOLIFIELD. Getting into a general consideration of all of these projects, it is my understanding in formulating the AEC budget for the physical research program that the Research Division makes recommendations to the Commission which must clear through the office of the AEC Controller.

Mr. FIELDS. Mr. Chairman, that is not quite true.

The various proposals from the divisions are brought up to the Commission for consideration. The controller's function is not to select or to recommend. He deals with the processing of the proposals and puts them into the context in which we are operating under the fiscal limitations that are imposed by the administration. The controller does not determine whether projects are or are not to be included in our budget.

Representative PRICE. Mr. Chairman, in this connection the total amount requested in this bill is for $193,379,000. Of that large amount there are just these two small items in here for physical research.

Is that all the projects that were submitted to the controller for consideration?

Mr. FIELDS. Mr. Price, they are not submitted to the controller.

Representative PRICE. How are they worked out? How did you come up with just two projects in the face of recommendations for a step-up in basic research?

Mr. FIELDS. There were a number of projects put forward to the Commission for consideration.

Representative PRICE. How many were put forward?

Mr. FIELDS. I do not recall the number but there were several others that were under consideration at the time.

Representative PRICE. Could you get a list for us of the ones that were under consideration and the disposition of them?

Mr. FIELDS. I presume we could. The budget is a continuing process, as you know; at any point and time you may look at it there may be some things up for consideration that were up before and some that are not up that were up before.

Representative PRICE. I think we could limit it to the recommendations that came up to the Commission from the Research Division and the Commission's action on the recommendations of the Research Division. Could we get up such a list?

Mr. FIELDS. I presume so. I would have to do a little research on it.

I can remember a number. I do not recall a specific project. There have been these matters of the construction of facilities at Oak Ridge, Brookhaven and Berkeley that we had authorized before and which are now deferred.

Representative PRICE. Even that list would not begin to reflect the number of requests that come from the field to the Research Division, would it?

Mr. FIELDS. I suppose there would be some requests that the Research Division did not feel were ready to be considered as well as those which it might have been discussing.

Representative PRICE. We should know what the Research Division considers to be important and which do not show in this authorization request.

In addition to that, are there any projects not included in this bill that were requested by the Commission and rejected by the Bureau of the Budget?

Mr. FIELDS. We provided you with a table that did include all projects that were proposed by the Commission. I believe you have Table 8. On the second page there is the metals and ceramics research building at Oak Ridge in the amount of $6½ million and the metals process development plant at Ames, Iowa, in the amount of $1,900,000, which the Commission did send to the Bureau of the Budget.

Representative PRICE. Did the Commission submit to the Bureau of the Budget the high-circuit cyclotron at Berkeley for experiments in transuranium elements?

Mr. FIELDS. I do not believe they did, sir.

There is a heavy ion accelerator out there. That was covered in previous budgets.

Representative PRICE. I am referring to the one that Dr. Seaborg is working on and has transmitted requests to the Commission.

Mr. FIELDS. I am not aware of any such item in our request to the Bureau this year. There is not such an item in this request.

Representative PRICE. Dr. Williams, is there anything in your Division on that particular item?

Mr. WILLIAMS. This was not on the list submitted by the Commission.

Representative PRICE. What are we doing to compete with the Russians in this important field of research on transuranium elements? Are we doing anything on it?

Mr. WILLIAMS. Yes. Seaborg's present work is using the 60 inch cyclotron which is located on the main Berkeley campus. The building housing the 60-inch cyclotron which Seaborg has been using is to be torn down to make room for a new incoming chemistry building and his need for a new high-current cyclotron will be contingent upon the tearing down of that building and the replacement of that facility with a new and modernized facility.

That is what Professor Seaborg is referring to in his talks with you people.

Representative PRICE. Is there a request in your Division?

Mr. WILLIAMS. There is such a request.

Representative PRICE. How long has it been in?

Mr. WILLIAMS. I cannot answer that question because I have not been there but 3 or 4 weeks. It is only recently, I am sure.

Representative PRICE. Are you familiar with such a request, General Fields?

Mr. FIELDS. I do not recall. It may well have been discussed in the processing. I would have to go back and review it.

I know there is work of the nature that Dr. Williams indicated. I believe we do also have some plans also for radiation of quite a bit of material in the engineering test reactor for this particular project.

Representative PRICE. Would Dr. Davis have any information on this particular item?

Mr. DAVIS. No, sir; I am afraid not.

Representative PRICE. General Fields, did you complete enumerating the projects that went to the Budget that were not approved by the Budget?

Mr. FIELDS. May I go through this list quickly?

Representative PRICE. Yes.

Mr. FIELDS. I believe those are the only ones in the Research Division budget.

Representative PRICE. Could I go through the list that we understand are in the Research Division and see if any of those have advanced to the stage where they have been either approved or disapproved? I think you have already mentioned Ames. Is that correct?

Mr. FIELDS. That is correct.

Mr. RAMEY. May I ask a question on the Ames project?

Has not that proposal been up several years to build a development building there in support of your basic research?

Mr. FIELDS. I believe it has been proposed by Dr. Spedding over a number of years.

Mr. RAMEY. And by the field office, recommended to the Division of Research in Washington?

Mr. FIELDS. I do not recall. It could well be that it was.

Representative PRICE. What would you say, to get back to Berkeley, is the status of Dr. Seaborg's request for his machine for the study of transuranium elements? Is it under consideration in the Division of Research?

Mr. WILLIAMS. That is right, sir.

Representative PRICE. The project you mentioned for Ames which was rejected by the Bureau of the Budget was for a metal processing plant, is that right?

Mr. FIELDS. It is more for metals process development work rather than a processing plant as such. As you know, Ames does a good deal of metallurgical work on process development in various metals, for us. This would be in the nature of a process development plant rather than an actual processing plant, if I can draw the distinction.

Representative PRICE. Do they also have a request for a research reactor at Ames?

Mr. FIELDS. They have from time to time indicated they thought it would be very helpful if they had a research reactor like the CP–5 there in order to conduct their metals research.

Representative PRICE. No action has been taken on that?

Mr. FIELD. No action has been taken on that. It has not been included in the requests that have gone forward.

Representative PRICE. At Argonne, you have an item for a high-energy accelerator. What is the status of that?

Mr. FIELDS. The high-energy accelerator was authorized in 1957 for $15 million and increased last year to $27 million.

Representative PRICE. This is the same project?

Mr. FIELD. It is still the same project. It is still current. We are requesting appropriations toward that this year. We had a million and a half, which was sufficient last year for that work to proceed.

Representative PRICE. The item in this bill for Argonne, 59–e–2, is a modification of the existing CP–5; is that right?

Mr. FIELD. That is true. To raise the power level of it and get a higher flux.

Representative PRICE. They have had a request for some time for a new CP–5. What is the status of that?

Mr. FIELDS. That has not gone forward. I believe it was considered, but was not submitted.

Representative PRICE. These are regarded as important items by the research people in the field. Final action has not been taken on them. These are just recommendations from the field?

Mr. FIELDS. That is right.

Representative PRICE. I would like to have a comment on them, if there is any comment to be made. At Argonne Laboratory, we mentioned the accelerator, for which authorization has gone through.

Mr. FIELD. Yes, sir.

Representative PRICE. No action on the the request for a new CP–5?

Mr. FIELDS. I think it was considered a year ago, and turned down. I do not know the present status or whether the request is current or not. I would have to review it.

Representative PRICE. We were out there some weeks ago, and this is one place where we could see the need of space. We could see the

crowded conditions. We also saw the backlog of scientists waiting to do work on the existing CP–5 out there. It would appear that, if there is any place where you need a new instrument, it would certainly be at Argonne.

Mr. FIELDS. We have a number of research installations.

Representative PRICE. What is the backlog of scientists waiting to work on the CP–5 there?

Mr. FIELDS. I do not know, sir. I know there are many experiments that could be run on that. We are short of test-reactor space of all kinds. We are looking forward to taking measures through which additional space can be made available.

Representative PRICE. We were told there at the time that scientists have to wait anywhere from 6 to 8 to 10 months before they can get in to work.

Mr. FIELDS. It may be true in instances; yes, sir.

Representative PRICE. Mr. Chairman, I have a list of recommendations for facilities from the different laboratories in the field. I do not want to go through them one by one, because it would take all afternoon.

Representative HOLIFIELD. I think it would be a good addition to our record to have information on that from the Commission in writing.

(Correspondence between the committee and Commission on this matter follows:)

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C., May 27, 1958.

Mr. LEWIS STRAUSS,
Chairman, Atomic Energy Commission, Washington, D. C.

DEAR MR. STRAUSS: During the course of the Joint Committee hearings on H. R. 12459, the fiscal year 1959 authorization bill as requested by AEC, the question arose as to the adequacy of the present level of support of the physical research program. It was noted, in particular, that only two small items were included under physical research in the 1959 construction budget request, and that both of these were for improvements to existing facilities rather than for new projects.

In line with the request that I made to the General Manager during his appearance before the committee on May 19, 1958, it would be appreciated if the Commission would provide the committee, preferably within a week's time, with certain information regarding recommendations of the AEC Research Division for funding the physical research program in the 1959 budget. Specifically, it is requested that the Commission provide the following information on each project proposed by the Research Division for inclusion in the supplemental 1958 construction budget and the 1959 construction budget:

(*a*) A description of the project and the amount requested by the Research Division for that project.

(*b*) The justification for each project as submitted by the Research Division.

(*c*) Whether the Commission included the project in its submission to the Bureau of the Budget, and, if the project was not submitted to the Budget Bureau, the reasons for this decision.

(*d*) If the project was submitted to the Bureau of the Budget, what action was taken by the Bureau, and what reasons were given for that action.

Your prompt attention to this request for information will be greatly appreciated.

Sincerely yours,

MELVIN PRICE,
Chairman, Subcommittee on Research and Development.

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., June 5, 1958.

Mr. MELVIN PRICE,
Chairman, Subcommittee on Research and Development,
Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. PRICE: This is in reply to your letter of May 27, 1958, requesting information relative to the projects recommended by the AEC Research Division for authorization by the Congress.

The enclosed table lists projects submitted by the Division of Research for inclusion in the 1959 authorization bill in connection with both the original 1959 budget submission and the later amendment of the 1959 budget. The table also indicates which of these projects were included in the Commission's submission to the Bureau of the Budget and those which were included in authorization bills submitted to the Congress.

Relative to those projects which were not submitted to the Bureau of the Budget by the Commission, you are advised that three of the items requested under the particle accelerator program, the MURA, Stanford, and Oak Ridge accelerators, were deferred for further study. In accordance with the policy of the administration to defer all but the most essential projects, the Commission, after careful review, determined that the other projects not submitted were not as essential as those which were submitted to the Bureau of the Budget.

The reasons for the action taken on projects submitted by the Commission to the Bureau of the Budget but not submitted to the Congress, have previously been discussed in hearings before your committee on May 19, 1957. At that time, Mr. Merriam represented the Bureau of the Budget and the General Manager presented the Commission's position in this matter.

Sincerely yours,

LEWIS L. STRAUSS, *Chairman.*

UNITED STATES ATOMIC ENERGY COMMISSION

Data prepared in reply to a request for information on the physical research program, by Hon. Melvin Price, chairman of the Subcommittee on Research and Development, Joint Committee on Atomic Energy, Congress of the United States, in his letter of May 27 to Mr. Strauss, Chairman, United States Atomic Energy Commission

Action for request for authorization of physical research projects, fiscal year 1959

[In millions]

Project title	Research Division request	AEC submission to BOB	Submitted to Congress in authorization bills
Base budget:			
General plant projects	$1.5	$1.5	$1.5
Expansion of stable isotope production capacity, ORNL	.9		
Metals and ceramics research building, ORNL	6.1		
Central research laboratory addition, ORNL	3.0		
Accelerator improvements, UCRL	1.3	.5	.5
Chemistry building addition, UCRL	1.0		
Research reactor, Ames	3.8		
Metals process development plant, Ames	1.9		
Chemistry hot laboratory, ANL	[1] 4.4		
Physics building, BNL (would replace project 57-h-2 if authorized)	3.0		
High flux research reactor, BNL	10.0		
Total	36.9	2.0	2.0
Amended budget:			
Physics building, BNL (increase in prior authorization for 57-h-2) [2]	.9		
Permanent research buildings, ORNL:			
Metals and ceramics research building, ORNL [2]	6.5	6.5	
Central research laboratory addition, ORNL [2]	3.5		
Particle accelerator program:			
MURA accelerator	100.0		
Stanford accelerator	78.0		
Oak Ridge high energy accelerator	25.0		
UCRL cyclotron	[3] 3.0		
ANL 10 Mev. Van de Graaff	2.5		
ORNL cyclotron	3.0		
Research and engineering reactor, ANL	9.7		
CP-5 reactor improvements, ANL	.5	.5	.5
Chemistry building addition, UCRL [2]	2.0		
Research reactor, Ames [2]	3.8		
Metals process development plant, Ames [2]	1.9	1.9	
High-energy physics building, Columbia University	.5		
Expansion of stable isotope production capacity, ORNL [2]	.9		
High flux research reactor, BNL [2]	10.0		
Particle accelerator program (increase in prior authorization for the Harvard-MIT and Princeton-Penn accelerators)		9.4	[4] 9.4
Particle accelerator program, Cambridge accelerator	1.3		
Total	253.0	20.3	11.9

[1] AEC subsequently informed the Joint Committee this item was inadvertently omitted from the amended budget.
[2] Project previously submitted in base budget.
[3] AEC subsequently informed the Joint Committee this amount should have been shown as 5.0.
[4] Submitted as amendment to fiscal year 1956 authorization bill.

JUSTIFICATION FOR PROJECTS SUBMITTED IN BASE BUDGET

General plant projects, $1,500,000

This consolidated budget request provides for the minor and often individually unpredictable capital improvements, modifications and additions that are required each year in conjunction with the research and development programs at the Oak Ridge National Laboratory, the Ames Laboratory, and the off-site physical research program.

The funds requested for fiscal year 1959 may be listed as follows:

1. Oak Ridge National Laboratory	$1,200,000
2. Ames Laboratory	50,000
3. Off-site research program	250,000
Total, fiscal year 1959 obligations	1,500,000

General plant projects, Oak Ridge National Laboratory, $1,200,000

The Oak Ridge National Laboratory does research and development in all fields of the atomic energy program and each of the many activities has its associated capital requirements. In addition, the program at Oak Ridge National Laboratory is characterized by its rapidly changing nature and each major change in direction or scope usually generates a demand for an alteration or addition to the physical facilities involved. The net result of both of those factors is an annual requirement for a substantial fund for minor capital items that are impossible to predict with any specificity.

General plant projects, Ames Laboratory, $50,000

The Ames Laboratory is also provided with an annual fund to cover the minor capital requirements to the existing Atomic Energy Commission and Iowa State College-owned facilities. As research projects progress, change, or are terminated, and as new projects are initiated, relatively minor improvements or modifications are required. As in the case of the other laboratories, it is not possible to predict the specific items to be covered under this caption, but the estimated level is based on past experience and the expansion or contraction of the physical research program at the Laboratory.

General plant projects, off-site physical research program, $250,000

Under the off-site physical research program, a number of contractors are using or will soon be using very large facilities such as cyclotrons, synchrotrons, and other particle accelerators. These facilities require the same type of modifications and additions as the Commission's laboratories in order to keep abreast of the progress in their research programs. The funds in this project are required to permit better utilization of these devices and facilities.

Expansion of stable isotopes production capacity, Oak Ridge National Laboratory, $900,000

This project provides for the modifications and additions required to activate 12 wartime electromagnetic (beta-type) isotope separators so that the Oak Ridge National Laboratory's production of stable isotopes can be expanded by a factor of 4. This facility is required to meet the increased demand for stable isotopes.

Since the inception of stable isotope production at ORNL, production has been carried out in four separators that were originally installed in building 9731 to serve as the pilot plant for the Y–12 electromagnetc U–235 separations plant. The current capacity of this facility is satisfactory to meet the normal research requirements for small samples of enriched stable isotopes; however, the complete and accurate measurement of nuclear cross sections requires large samples. This additional requirement cannot be met with the present facilities and at the same time continue to meet the other equally important production requirements. Examples of some of the other production requirements include the production of—

1. High purity isotope collections,
2. Adequate amounts of rare isotopes,
3. Stable isotopes for dilution analyses,
4. Stable isotopes to be used as starting materials in the production of high specific activity radioisotopes,
5. Enriched natural radioactive isotopes useful in basic research and as tracers, and
6. The wide variety of isotopes constantly in demand for nuclear physics research.

The proposed facility will enable the laboratory to meet the increased production requirements and improve the quality of the isotope separations. Separating the isotopes of many of the elements is difficult and expensive. Only small amounts of some isotopes, and only low purities of others, have been obtained. In some cases, only 1 or 2 collections have been possible. Increased separator time will be necessary to improve the production efficiency of many isotopes such as those of bromide, dysprosium europium, gadolinium, hafnium, iridium, ruthenium, selenium, tungsten, and vanadium.

Metals and ceramics research building, Oak Ridge National Laboratory, $6,107,000

This project provides for the construction of permanent, consolidated, and expanded facilities for the metallurgical research and development activities

at Oak Ridge National Laboratory. The proposed facility will be housed in an L-shaped building southwest of and joined to the central research building by a small building unit.

Progress of reactor development depends upon the solutions of crucial metallurgical problems associated with the structural materials. There will be a continuing need for large-scale metallurgical research and developmental activities in support of reactor development for as far into the future as one can see.

The recent expansion of the research and development activities associated with reactor projects makes the metallurgy research and development facilities at Oak Ridge National Laboratory entirely inadequate. The main metallurgy building (2000) is overcrowded in every type of space—office space, laboratory space, and service and equipment operating areas. For more effective work and less hazardous operation, it would be necessary to provide additional space for the people now occupying building 2000. Additional people must also be added to the program.

Upon the completion of the currently authorized plans, metallurgical and development activities will be housed in 11 different buildings, most of which are located in the X–10 area. This temporary plan will fall short of providing adequate quarters for the long-range metallurgical research and development activities. The possibility of increasing the utilization of space in other temporary buildings has been considered. However, experience has demonstrated: (1) that temporary buildings constructed for other uses can seldom be converted into adequate metallurgical research facilities, (2) the renovation for fire protection and safety and the installation of metallurgical facilities into temporary buildings is unduly expensive, and (3) that it is undesirable to locate related metallurgical research and development activities in separate buildings. It is requested that $200,000 be made available in fiscal year 1958 in order to begin the design work on this project.

Central research laboratory addition, Oak Ridge National Laboratory, $3,035,000

This project provides for the construction of additions to the Oak Ridge National Laboratory central research building, No. 4500, to permit relocation and permanent housing at the main laboratory site for the physics, materials, and analytical chemistry research groups presently located in temporary facilities at the Y–12 plant. The physical separation of these research groups from the rest of the laboratory's staff reduces the overall effectiveness of the laboratory's research potential.

A proposal was included in the fiscal year 1956 budget and subsequently authorized (project 524–56–h–1) in the amount of $1,150,000 to convert a building in the Y–12 area to a research and development facility for the Y–12 physics and chemistry research group and also a small temporarily housed group from the biology division. In order to achieve the maximum research effectiveness, the original plan to spend $1 million to provide permanent space in building 9207 for the Y–12 physics and chemistry groups has now been canceled. Instead, it is proposed that $3,035,000 be provided for the construction of new additions to the central research laboratory (4500) to provide space for these groups at the main laboratory site. The small biology group will be provided with permanent research facilities in building 9207 as originally planned at a cost of $150,000.

Design studies of the facilities required to house the Y–12 research personnel are being performed together with the laboratory addition authorized in 1957 (part A, project 524–57–h–1) to insure that the building plans for the two facilities will provide for the integration of the presently separated research groups in a manner that will achieve the maximum effectiveness within each scientific field and produce the maximum economy in operations. Consolidated design made it possible to include many cost-saving design innovations and improvements in the proposed facilities as a result of the operating experience on the present central research laboratory and thereby reduce the building cost to $17.77 per square foot. The design of the combined facilities was completed at the end of fiscal year 1957 and will be held pending action on this project and the request for the funding of project 57–h–1, part A in fiscal year 1958.

Accelerator improvements, University of California Radiation Laboratory, $1,325,000

This project provides for accelerator improvements to the existing Berkeley accelerators. It includes improvements to the bevatron, the 184-inch cyclotron, the heavy ion accelerator, and to the research equipment and facilities which are utilized in conducting experiments with these machines. Included are such

items as magnets, shielding, research caves, scattering chambers, counting facilities, and additional mechanical and electrical utilities.

These additions and improvements are required to increase the versatility, effectiveness, and utilization of these machines as research tools. The expanded physical research program at Berkeley contempates an increase in the variety and number of experiments utilizing the accelerators. These improvements will provide the means for increasing their utilization and for increasing the scope and type of experiments that can be conducted with each of the accelerators.

Chemistry building addition, University of California Radiation Laboratory, $985,000

This project provides for an addition to the chemistry building (No. 70) at the University of California Radiation Laboratory. The chemistry building was designed in 1951 to provide laboratory and office space for approximately 100 people and to accommodate the program being conducted at that time. Since 1951, the chemistry research staff has increased to 140 people, but an even more significant demand upon the present building has resulted from the progress and the changed character of the research program.

The chemistry program now requires more specialized space for high radiation experiments and for more and larger research apparatus installations. Working space within the building is now at a premium. Recent moves to provide more laboratory space have forced the displacement of several groups into smaller rooms and, in some cases into other buildings. The need to provide technically adequate space to utilize the equipment on hand and under development will continue to force the displacement of research groups to other buildings and areas with a resulting disruptive effect to the program. Moreover, the availability of alternative space at the University of California Radiation Laboratory is extremely limited and the availability of space will become even more limited as the physics and chemistry programs continue to progress.

This situation, coupled with the program requirements for the immediate future, makes it imperative that the proposed addition be constructed in fiscal year 1959.

Research reactor, Ames Laboratory, $3,765,000

This project provides for the construction of a research reactor and the construction and initial equipping of the related building at Ames Laboratory. The proposed reactor is a thermal heterogeneous reactor of the type of the Argonne CP–5 reactor, using highly enriched fuel, cooled and moderated with heavy water. Utilization of Argonne National Laboratory experience will be most helpful in reducing the time and expense of development to a minimum.

The acquisition of a reactor by the Ames Laboratory would round out the basic research programs now in progress in chemistry, physics, metallurgy, and engineering, and would assist the laboratory to produce pure metals and other materials for use throughout the atomic energy program. At the present time the pure metal program is expanding rapidly. Analytical control, however, is essential for the production of these materials. A reactor as a part of the Laboratory's facilities would permit the development of a program in activation analysis which in turn would improve the quality of the materials being produced. Other programs which require the use of a reactor are those requiring structural analysis by neutron diffraction and chemical and metallurgical programs requiring isotopic tracers of short half life.

There are large areas of engineering where fundamental research must be done in order to keep ahead of the applications of the results of such research in actual practice. A laboratory, like Ames Laboratory, which is not completely concerned with application and development, is the ideal place for such research. The reactor would also benefit the Nation's atomic energy program as a training facility. For the past 4 years, Iowa State College has had a nuclear engineering curriculum for graduate students leading to a master's degree. This would expand and become more effective if a reactor were available to the faculty and students. It is requested that $250,000 be made available in fiscal year 1958 in order to begin the design of this project.

Metals process development plant, Ames Laboratory, $1,870,000

This project provides for the construction and initial equipping of a research and process development facility at Ames Laboratory. The Laboratory now has two buildings known as the metallurgy and research buildings containing 30,000 and 60,000 square feet of working area, respectively. In addition, the Atomic Energy Commission rents from Iowa State College, a total area of approximately

29,000 square feet in the chemistry and physics buildings. Except for limited area in the basement of the metallurgy building, none of the space is adapted to work on a developmental scale.

Additional space for developmental work is needed to carry out the pure metals program which the Atomic Energy Commission has asked the Ames Laboratory to undertake. This program is to satisfy an increasing need by metallurgists and solid state physicists in several Atomic Energy Commission laboratories for pure metals for their investigations. The program also includes preparation of several of the less known metals and alloys for evaluation of their use in the Atomic Energy Commission program. In order to perform the research necessary to prepare high purity metals and to produce them in sufficient quantity, the Ames Laboratory must have the proposed building.

The developmental building is also needed to provide space for process development. Research and development work on larger than the laboratory scale is essential to evaluate the commercial feasibility of processes and to produce a sufficient quantity of new metal for metallurgical and engineering research. It is felt that development work should be carried on at Ames where the experts that carry the processes through the research stage can also help carry them into the larger scale process development.

A number of other solutions to the present space problem have been proposed but have been found inadequate. The diversion of space in either the research or metallurgy buildings to larger scale research projects is unsatisfactory for several reasons: (1) Such space could be diverted only by reducing or eliminating other productive research, (2) any attempt to use research laboratory space for larger operations is uneconomical, (3) developmental space should be flexible so that changes can be made readily and the existing buildings do not have this flexibility, and (4) the electrical supply and the ventailation systems of the research laboratories could not handle the larger developmental operations. There is also no possibility of renting additional laboratories from Iowa State College. The college has no suitable space and the increasing college enrollment will soon bring pressure from the college for the release of the space now being rented in the chemistry and physics buildings. It is requested that $20,000 be made available in fiscal year 1958 so that the design work on this project can be completed.

Chemistry hot laboratory, Argonne National Laboratory, $4,415,000

This project provides for the construction of a hot laboratory that will be connected to the present chemistry building at the Argonne National Laboratory. The levels of radioactivity encountered in nuclear chemistry research have increased substantially in recent years and even greater increases are essential to the continuation of an effective program in this area. The availability of research reactors with substantially greater flux and particle accelerators with higher energies insures that the increases in the levels of activity will continue.

The irradiated plutonium program illustrates the inadequacy of the present facilities and the trend toward higher level radiation experiments in the chemistry program. In the study of the transplutonium elements, the Chemistry Division has processed sizable amounts of irradiated plutonium. In the past the remote processing of the irradiated plutonium has been done in the building 40 cave, where shielding and working space in several instances has not been adequate. The Chemistry Division is now engaged in a new program of irradiating plutonium fuel rods to produce larger quantities of the transplutonium elements. Previous experience indicates that the existing building 40 cave will be completely inadequate in gamma ray shielding containment of alpha activity, and available working space when quantities of irradiated plutonium of this magnitude are processed. The substantial neutron emission arising from spontaneous fission of the curium and californium produced in the irradiated plutonium and from the alpha, neutron reactions will be an additional hazard that will make the present facilities inadequate.

In 1958 and 1959, when the first of the fuel rods now in the MTR are ready for processing, arrangements have been made to make use of the chemical engineering hot cave which is now under construction. This facility will not be available for regular use, however, because of the requirements of the reactor development program for the chemical processing of spent fuel elements.

This program is one of a number of equally important chemistry programs that will require a facility of the type proposed in this project in order to continue

their investigations at higher radiation levels. The following programs will also require similar special shielded facilities:

1. Micro studies of intensely radioactive nuclides
2. High flux studies
3. Chemical and physical studies of radiation effects
4. Chemical and radiochemical analytical studies
5. High level alpha experiments

Physics building, Brookhaven National Laboratory, $3,000,000

This project provides for the construction of permanent physics laboratory building at the Brookhaven National Laboratory to provide laboratory, office space for the physics staff of the laboratory. The quarters for the physics department at Brookhaven, with the exception of those at the major machines, are the most inadequate in the entire laboratory. The staff is widely dispersed in a number of temporary buildings that are in a serious state of deterioration. These buildings which were of temporary construction, were originally used by the CCC in the midthirties. They are inadequate for the activities they house and their wide dispersion has prevented or handicapped many experiments, while the wide dispersion of the physics staff has reduced the cohesiveness and cross-fertilization of the program. The net effect has been the maintenance of a research program under the most arduous and costly conditions. The proposed building will alleviate this situation and will centralize the activities of the physics department in a building that will be in close proximity to the cosmotron, the cyclotron, the reactor, and the alternating gradient synchrotron.

High flux research reactor, Brookhaven National Laboratory, $10,000,000

This project provides for the authorization of the construction of a high flux research reactor at Brookhaven at the cost of $10 million. An appropriation of $1 million is requested in fiscal year 1959 for the necessary design work and special procurement. The reactor will use fully enriched uranium-aluminum fuel elements, with heavy water as a moderator, coolant, and reflector. When operated at 20 megawatts of power, it will provide a total flux of 1.5×10^{15} neutrons per square centimeter per second in the reactor core and a thermal flux of 5×10^{14} in the reflector.

A higher flux reactor is needed at Brookhaven to satisfy two needs: (1) Experiments which could be done with a higher flux reactor in a matter of days now require weeks and months to complete. The demonstrated advantages of such a machine as the "fast chopper" in yielding significant data in regions of energy requiring a high flux of resonance neutrons, become almost wasted if such neutrons are not available in sufficient amount to permit such data to be acquired in reasonable amounts of time. (2) Many experiments do not give significant results without sufficiently high flux to yield detectable effects. Some of these are due to the ratio between flux and background effects; others such as the manufacture of certain radioisotopes of short half-life require higher fluxes in the first instance.

In addition to the need for higher fluxes in general, this proposal recognizes the need for higher fluxes in an energy range above thermal. Thus, emphasis has been placed on a core design which will maximize such fluxes, and the design of the experimental facilities has been such that maximum advantage is taken of the high resonance flux. It is felt that a most serious lack of basic data still exists in this neutron energy range and therefore future work should emphasize greater precision in neutron interaction measurements for these energies.

This proposed Brookhaven high flux research reactor will complement the present reactors by providing resonance fluxes several hundred times greater than those available. The laboratory's facilities are supplemented from time to time by the addition of accelerators providing different energy ranges. In the same way new reactors should be provided to supplement making available substantially increased intensities. The provision of the high flux reactor along with the continued use of the present research reactor will assure a continuing, strong research program in basic neutron physics and solid state physics at Brookhaven.

JUSTIFICATION FOR PROJECTS SUBMITTED IN AMENDED BUDGET

Physics building, Brookhaven National Laboratory, project 57-h-2, increase of, $900,000

This project provides for the construction of a permanent physics laboratory building that will be connected with the east wing of the existing cosmotron building. The building will furnish a much needed consolidation of high energy

physics activities by providing departmental offices for the continuing physics staff; offices and laboratories for sicentists engaged in research in nuclear structure, neutron physics and extranuclear properties of matter; departmental services such as a machine shop, a stockroom, a library, and conference rooms; and office and computer areas for the Applied Mathematics Division.

The quarters for the physics department at Brookhaven are the most inadequate in the entire laboratory and many staff members are widely dispersed in a number of temporary buildings that are in a serious state of deterioration. These buildings are costly to heat, costly to maintain, and constant repairs are necessary. In addition, they are inadequate for the activities they house and their wide dispersion seriously hinders the overall efficiency of operations. Some nuclear physics experiments have been prevented and others have been impeded by the inadequacy of the buildings. The net effect has been the maintenance of a research program under the most arduous and costly conditions. The proposed building will alleviate this situation and will centralize the activities of the physics department.

Premanent research buildings, ORNL, $10,000,000

The proposed instrument laboratory addition would consolidate similar activities and do away with some temporary and makeshift housing. At present, only about one-half of the instrumentation and controls division is located in a suitable permanent building. The balance is housed in five scattered buildings that are seriously overcrowded or poorly located and the division is particularly handicapped by the lack of facilities for the assembly of large items of equipment and a lack of suitable space for component testing, instrument, development, and for working with small quantities of radioactive materials. The pressures on the division are great and they are expected to become increasingly more stringent.

The metals and ceramics building provides a permanent, consolidated, and expanded facility for those groups conducting metallurgical studies and experimentation on metals and ceramics. The proposed facility will be an L-shaped building southwest of and adjoining the research building. The building will provide 87,100 gross square feet, to be used for conventional laboratories, workshop laboratories, and offices. A high bay area will provide 19,300 gross square feet for operations such as test loops, component mockups, large-scale engineering tests, melting and casting and metal forming exclusive of plate-type fuel-element fabrication operations. The basement will provide 43,600 square feet for service areas and also will be used to house an area machine shop to serve the metallurgy programs and the chemical technology programs being carried out in the adjoining wing of the research building.

Experience has shown that progress of reactor development in all fields is strongly dependent upon the solutions to crucial metallurgical problems associated with the structural materials used in vital reactor components. At Oak Ridge National Laboratory, experience in the development of aqueous homogeneous reactors and fused-salt fluid-fuel aircraft reactors has shown quite clearly that, in these two particular cases, the problems of finding adequate structural materials are paramount in the successful accomplishment of the objectives of the development programs. As development advances toward reactors of higher performance, where operating temperatures and radiation intensities are set as high as possible to achieve the performance objectives, it can be expected that the metallurgical problems will become increasingly more severe. It is clear that there will be a continuing need for large-scale metallurgical research and development activities in support of reactor development.

Particle accelerator program, fiscal year 1959

	Authorization	Fiscal year 1959 funds
1. MURA	$100,000,000	$15,000,000
2. Stanford	78,000,000	
3. Oak Ridge high-energy accelerator	25,000,000	
4. UCRL cyclotron	3,000,000	200,000
5. ANL 10-Mev. Van de Graff	2,500,000	2,500,000
6. ORNL cyclotron	3,000,000	3,000,000
Total	211,500,000	20,700,000

1. *MURA.*—The Midwestern Universities Research Association (MURA) proposed in the spring of 1956 the construction of two 15–20-Bev., high-intensity, fixed-field, alternating-gradient synchrotrons which, when the colliding-beam technique is employed, makes them, for certain experiments, equivalent to a single accelerator of 540 Bev. Even without the colliding beams, the intensity from one of these machines should be greater by a factor of about 1,000 than the highest intensity accelerator now under construction. The preliminary cost estimate was $100 million over a period of construction of 7 to 8 years. A more detailed supplemental proposal is to be submitted to the Atomic Energy Commission, the National Science Foundation, and the Department of Defense in February 1958.

2. *Stanford.*—Stanford University has proposed a 30–45-Bev. electron linear accelerator, based on design of presently operating accelerators. The estimated cost of construction is $78 million, with 6 years as the estimated time of construction. This proposal has been submitted to the Department of Defense, the National Science Foundation, and the Atomic Energy Commission. The Department of Defense is taking steps to speed up the development of high-powered klystrons, largely because of their interest in this accelerator. No firm plans to support the construction of this accelerator by the Department of Defense or the National Science Foundation have come to the attention of the Division of Research.

3. *Oak Ridge high-energy accelerator.*—The Oak Ridge National Laboratory and the Southern Regional Accelerator Committee of ORINS have jointly proposed a high-intensity proton accelerator consisting of a 900-Mev., fixed-field, alternating-gradient cyclotron injector and followed by an alternating-gradient synchrotron with a maximum energy of about 12 Bev. The estimated cost is $20 million to $25 million, and the estimated time of construction about 5 years.

4. *UCRL cyclotron.*—This project consists of a continuous-wave, high-current, relativistically compensated, constant-frequency cyclotron, its building and appurtenances. The cyclotron will be designed to accelerate alpha particles, deuterons, and protons, and, perhaps, other ions, with energy ranges of 100, 50, and 25 Mev., respectively, for the first 3 types of ions. The energy spectrum to be made available by this accelerator for various ions is becoming vitally necessary to certain UCRL research programs. In addition to the logical extension of most research programs now utilizing the 60-inch cyclotron, several nuclear chemistry programs are dependent on strong sources of radioactivity for continuation of their work. These programs include the atomic-beam research, the high-resolution alpha, beta, gamma spectroscopy, and mass spectrograph studies. Other physics and chemistry programs which will greatly benefit from the availability of this accelerator will be the medium-energy tritium production studies.

5. *ANL 10-Mev. Van de Graaff.*—The present ANL Van de Graaff, which was built in 1948–49, has a maximum energy of 3.5 Mev. and is now operated in excess of 2 full shifts. A full third shift will probably be provided shortly. The Laboratory has developed a very capable staff in this area of work, which provides insurance that the full potential of the 10-Mev. machine will be exploited. In addition, it is essential that the Laboratory's Van de Graaff program be extended into the higher energy region. This machine will be closely associated to ANL primary mission; namely, reactor development. Some of the investigations which would be particularly interesting at the higher energies (up to 10–12 Mev.) are:

1. The high-energy machine could bridge the neutron gap between 10–14 Mev. The precision neutron cross-section program could, therefore, be extended through this region.

2. Basic scattering problems, p–p, p–a, etc.: Very few measurements of high precision exist in the energy range 6–11 Mev. for these important problems.

3. Elastic scattering: Of particular interest, for example, is scattering by zero-spin nuclei for which unambiguous spin and parity assignments could be made to states not heretofore investigated.

6. *ORNL cyclotron.*—Since authorization of the 48-inch heavy-particle cyclotron in fiscal year 1957, there have been several significant technological breakthroughs in cyclotron design at ORNL. As a result, it is now proposed to abandon the original design of the 48-inch cyclotron in favor of the design and construction of a more advanced machine. The new cyclotron will incorporate an azimuthally varying magnet field and a variable frequency resonant and oscillator system in place of the conventional fixed-frequency system of the original 48-inch cyclotron design. The new design will provide a variable-energy, high-beam

current cyclotron capable of accelerating protons up to 75 Mev., deuterons up to 40 Mev., alpha particles up to 80 Mev., and heavy particles, such as carbon, to 85 Mev. Due to the increased versatility and usefulness of the new cyclotron, it will be located in the main research area (X–10) of ORNL to permit greater utilization by all the basic research groups at ORNL. If this project is approved, project 57d–3, 48-inch heavy-particle cyclotron, ORNL, can be eliminated.

Research and engineering reactor, ANL

The present research reactor at Argonne is unable to meet the program requirements of the Laboratory. Even at the proposed 10-megowatt level, it will be necessary to delay many experiments critical to the reactor and research programs. And, in fact, due to the lack of space in the reactor, as well as the lack of adequate floorspace around the reactor for experimental equipment, it is just not possible to initiate some experimental programs which should even now be in progress. Furthermore, it will not be possible to handle the increasing number of requests for reactor space from the participating institutions.

From information received on the MTR–ETR activities, it is obvious that they cannot provide relief, even if we accept the expense, inconvenience, and delays which must be encountered when operating at the distances involved. Furthermore, the facilities of the MRT and ETR were not designed to handle many types of experiments which are an important part of the Laboratory's program.

Also of considerable importance is the effect on the Laboratory program of any prolonged shutdown of CP–5 necessitated by repair or replacement requirements. Under these circumstances, if a second reactor were in operation, the effect of a shutdown could be minimized by reassignment of priorities. Otherwise, a very large fraction of the Laboratory's program could be delayed.

A distinguishing feature of CP–5 will be its large number of versatile high flux irradiation facilities for engineering irradiation experiments as well as a full range of experimental access positions for research uses. It should be clear that this reactor is purely for the purpose of providing urgently needed additional rector space in the conventional flux ranges. This need is entirely independent of the national requirements for a truly high flux (approximately 10^{16}) research and testing reactor such as the Mighty Mouse reactor to which the Laboratory is now devoting as much development effort as the financial situation will permit.

CP–5 reactor improvements, ANL, $500,000

An increase to 10 MW will raise the flux of CP–5 to about 10^{14} and will increase considerably the value of the reactor for research experiments (e. g., bent crystal spectrometer, neutron chopper, neutron diffraction). It will also make possible studies of some of the transplutonium isotopes, which cannot be formed at the present flux levels due to the short half lives and the multiple-capture processes involved. Finally, it will reduce the time required for irradiations and inpile fuel irradiation loops.

An increase from the 2 MW to 4 MW has already been authorized and money made available ($380,000). Studies have shown that it will be possible to raise the reactor power to 10 MW with the provision of facilities for cooling spent fuel and of some additional cooling tower capacity.

Chemistry building addition, UCRL, $2 million

The chemistry building was designed in 1951 to provide space for approximately 100 people and to accommodate the program then being conducted. The chemistry group currently consists of 140 people, but an even more serious demand for more space has resulted from the changed character of the research program. For example, in 1951 a high radiation level experiment consisted of handling about 5 curies of radioactive material. The progress of the research now quite often requires experiments involving over 100 curies and in some cases over 1,000 curies. These higher radiation levels require additional shielding, more elaborate handling equipment, and increased ventilation. Also mass spectroscopy and atomic beam apparatus were in a stage of buildup in 1951. The UCRL chemistry group now has 13 large spectrographs and 3 atomic beam instruments. These items, not originally planned for in the present buildings, are quite similar to small accelerators and require relatively large amounts of space. In addition, counting equipment, computing devices and multichannel analyzers have grown more complex as research has progressed, with increasing encroachment on the limited space available for the chemists.

Research reactor, Ames Laboratory, $3,765,000

This project provides for the construction of a research reactor and the construction and initial equipping of the related building at Ames Laboratory. The proposed reactor is a thermal heterogeneous reactor of the type of the Argonne CP–5 reactor, using highly enriched fuel, cooled and moderated with heavy water. The acquisition of a reactor by the Ames Laboratory will round out the basic research programs now in progress in chemistry, physics, metallurgy, and engineering, and will assist the Laboratory to produce pure metals and other materials for use throughout the atomic energy program. At the present time the pure metal program is expanding rapidly. Analytical control, however, is essential for the production of these materials. A reactor as a part of the Laboratory's facilities will permit the development of a program in activation analysis which in turn will improve the quality of the materials being produced. Other programs which require the use of a reactor are those requiring structural analysis by neutron diffraction and chemical and metallurgical programs requiring isotopic tracers of short half life.

There are large areas of engineering where fundamental research must be done in order to keep ahead of the applications of the results of such research in actual practice. A laboratory, like Ames Laboratory, which is not completely concerned with application and development, is the ideal place for such research. The reactor would also benefit the Nation's atomic energy program as a training facility. For the past 4 years, Iowa State College has had a nuclear engineering curriculum for graduate students leading to a masters' degree. This would expand and become more effective if a reactor were available to the faculty and students.

Metals process development plant, $1,870,000

This project provides for the construction and initial equipping of a research and process development facility at Ames Laboratory. The Laboratory now has two buildings known as the Metallurgy and Research Buildings containing 30,000 and 60,000 square feet of working area, respectively. In addition, the Atomic Energy Commission rents from Iowa State College, a total area of approximately 29,000 square feet in the Chemistry and Physics Buildings. Except for limited area in the basement of the Metallurgy Building, none of the space is adapted to work on a developmental scale.

Additional space for developmental work is needed to carry out the pure metals program which the Atomic Energy Commission has asked the Ames Laboratory to undertake. This program is to satisfy an increasing need by metallurgists and solid state physicists in several Atomic Energy Commission laboratories for pure metals for their investigations. The program also includes preparation of several of the less-known metals and alloys for evaluation of their use in Atomic Energy Commission program. In order to perform the research necessary to prepare high-purity metals and to produce them in sufficient quantity, the Ames Laboratory must have the proposed building.

The Developmental Building is also needed to provide space for process development research and development work on larger than the laboratory scale is essential to evaluate the commercial feasibility of processes and to produce a sufficient quantity of new metal for metallurgical and engineering research. It is felt that development work should be carried on at Ames where the experts that carry the processes through the research stage can also help carry them into the larger-scale process development.

A number of other solutions to the present space problem have been proposed but have been found inadequate. The diversion of space in either the Research or Metallurgy Buildings to larger-scale research projects is unsatisfactory for several reasons: (1) such space could be diverted only by reducing or eliminating other productive research; (2) any attempt to use research laboratory space for larger operations is uneconomical; (3) developmental space should be flexible so that changes can be made readily and the existing buildings do not have this flexibility; and (4) the electrical supply and the ventilation systems of the research laboratories could not handle the larger developmental operations. There is also no possibility of renting additional laboratories from Iowa State College. The college has no suitable space and the increasing college enrollment will soon bring pressure from the college for the release of the space now being rented in the Chemistry and Physics Buildings.

High energy physics facility, Columbia University, $525,000

The high energy research group at Nevis uses, in addition to the Columbia cyclotron, the high energy accelerators at Brookhaven and Berkeley. It is ex-

pected that new accelerators at Cambridge, Princeton, Argonne, and the AGS at Brookhaven will also be used by the group. Much of the cosmotron higher quality work has been done by Columbia staff. Research done in this manner has had three distinct benefits. Firstly, by staging the experiments and developing the equipment at the university, it removes the workload from the already overcrowded shop facilities at Brookhaven. Secondly, it permits the university faculty to supervise the preparation of experiments without cutting into their teaching load. Thirdly, it permits graduate students to use for their thesis research the large accelerators at other sites while at the same time continue their class work at the campus. During the past 2 years the following students wrote doctoral dissertations using these:

Jack Leiner: Elastic scattering of negative Pi mesons by protons at 1.44 Bev—Dr. Leiner is now with Duke University.

N. Samios: Properties of neutral Lambda and Theta particles produced by 1.3 Bev negative Pi mesons—Dr. Samios is continuing his training as an instructor at Columbia.

M. Schwartz: Propane bubble chamber study of the reaction negative Pi meson plus proton yields negative Sigma plus positive K particle. Dr. Schwartz spent 1 year at BNC and has been appointed assistant professor at Columbia.

K. Lande: Long-lived neutral V particles—Dr. Lande is now with the University of Pennsylvania.

H. Blumenfeld: Observations of production, decay, and interaction of strange particles—Dr. Blumenfeld is now with Princeton.

The most critical problem confronting the Nevis group is that of adequate space. All available space is now used and it is apparent that the program has outgrown available space. Two factors have combined to intensify the space problem. One is that higher energy machines produce particles of higher momentum. This leads directly to an increase in the size of experimental apparatus needed to study these particles. The second is that as experiments become more sophisticated the complexity of the apparatus increases.

The additional space required has been planned with respect to existing facilities at Nevis. There no space is required for administration, stockroom, library, and similar functions. The following areas will be supplied:

	Square feet
1. Test floor	4,000
2. Shop	4,000
3. Laboratories	3,600
4. Scanning rooms	900
5. Miscellaneous (corridors, design space, toilets, etc.)	2,500
Total	15,000

At $23 per square foot based on present experience for construction in the New York area plus 10 percent contingency indicates the buildings will cost $375,000. Lathes, milling machines, and other tools would cost $100,000. The crane and temperature control equipment for the electronic apparatus would cost $50,000.

Expansion of stable isotope production capacity, $900,000

Production of stable isotopes is currently carried out in four separators that were originally installed at Y–12 to serve as the pilot plant for the calutrons. The production capacity of this facility is satisfactory only to meet normal research requirements for small samples (microgram quantities) of enriched stable isotopes. However, the complete and accurate measurement of nuclear cross-sections (the bread-and-butter program of the Commission) requires large (multigram quantities) enriched samples that cannot be supplied with present facilities.

This project would reactivate 12 wartime beta calutron separators that will expand stable isotopes production capacity by a factor of 4.

High-flux research reactor, BNL

This project provides for the authorization of the construction of a high-flux research reactor at Brookhaven. An appropriation of $1 million is requested in fiscal year 1959 for the necessary design work and special procurement. The reactor will use fully enriched uranium-aluminum fuel elements, with heavy water as a moderator, coolant, and reflector. When operated at 20 megawatts

of power, it will provide a total flux of 1.5×10^{15} neutrons per square centimeter per second in the reactor core and a thermal flux of 5×10^{14} in the reflector.

A higher flux reactor is needed at Brookhaven to satisfy two needs: (1) Experiments which could be done with a higher flux reactor in a matter of days now require weeks and months to complete. The demonstrated advantages of such a machine as the "fast chopper" in yielding significant data in regions of energy requiring a high flux of resonance neutrons, become almost wasted if such neutrons are not available in sufficient amount to permit such data to be acquired in reasonable amounts to time. (2) Many experiments do not give significant results without sufficiently high flux to yield detectable effects. Some of these are due to the ratio between flux and background effects; others such as the manufacture of certain radioisotopes of short half-life require higher fluxes in the first instance.

In addition to the need for higher fluxes in general, this proposal recognizes the need for higher fluxes in an energy range above thermal. Thus, emphasis has been placed on a core design which will maximize such fluxes and the design of the experimental facilities has been such that maximum advantage is taken of the high resonance flux. It is felt that a most serious lack of basic data still exists in this neutron energy range and therefore future work should emphasize greater precision in neutron interaction measurements for these energies.

This proposed Brookhaven high-flux research reactor will complement the present reactors by providing resonance fluxes several hundred times greater than those available. The Laboratory's facilities are supplemented from time to time by the addition of accelerators providing different energy ranges. In the same way new reactors should be provided to supplement making available substantially increased intensities. The provision of the high flux reactor along with the continued use of the present research reactor will assure a continuing, strong research program in basic neutron physics and solid-state physics at Brookhaven.

Particle accelerator program—Cambridge accelerator

The scale of operations envisaged for the future shows the need for additional laboratory space beyond that included in the present appropriation. The present accelerator buildings have been designed to allow this additional laboratory space to be added economically and efficiently. The laboratory-control building as designed will support a third floor to house research scientists and their laboratories; present space is adequate only for accelerator maintenance staff. The experimental building which is 100 feet deep can be extended in width from the present 120 feet to the full size of over 250 feet to provide the necessary experimental area, by extending the existing structure. Space is also provided for a cryogenic laboratory and for extension of the power building to house the increased number of motor generators and power supplies. All these additions can be built without intereference with presently planned construction. However, it is greatly desirable to have the buildings completed before start of operations in January 1960; this will require that funds be authorized by July 1958.

The following estimates of the costs of this additional space have been made with the assistance of the Chas. T. Main, Inc., engineers.

1. Enlarged experimental area, 14,800 square feet	$395,000
2. Third floor on laboratory-control building, 5,600 square feet	150,000
Laboratory furniture and equipment	20,000
3. Cryogenic Laboratory, 1,000 square feet	25,000
4. Power building addition, 11,100 square feet:	
Steel, structure, and services	229,000
3,500 kilovolt-ampere electrical substations	175,000
2,800 kilowatt water cooling system	41,000
	445,000
5. Engineering costs	25,000
Direct costs	1,060,000
6. Contingency, 15 percent	160,000
7. University overhead, 8-percent estimate	98,000
Total supplementary laboratory	1,318,000

Mr. FIELDS. I am sure you are aware, Mr. Price, if you add up everything that every one would like to do it begins to be a large list.

Representative PRICE. We recognize that. When you come in with two small ones like this, then it is a cause for some concern and it does lead to some questioning on the judgment exercised in allocating funds.

Representative HOLIFIELD. The Commission's General Advisory Committee, I believe, has recommended $28½ million for a program here. Is that true?

Mr. FIELDS. I do not recall, sir.

Representative HOLIFIELD. That would be in the operating fund.

Mr. FIELDS. I believe so.

Representative HOLIFIELD. Can you answer the question: Has their advice been taken in the operating fund or has that been cut down like your construction?

Mr. FIELDS. Mr. Chairman, a supplemental is now in the process of preparation for operating expenses.

I hope it will be before Congress very shortly, even by this weekend.

Representative PRICE. Referring to what you said about the amount of money that would be involved, we understand that it would be a very large amount. But unless you do some of it in a steady, continuous pattern, that amount it going to increase all the time. It is not going to get smaller.

The sad part of it is that we are going to be caught awfully short in a field that is most important to us.

Representative HOSMER. Mr. Chairman, in connection with those accelerator improvements, how many new takeoff points have gone into those accelerators?

Mr. WILLIAMS. There is no detailed planning for this Mr. Hosmer. They give examples in some backup sheets of what they did in 1958. But there are no cost elements available to us in the Division at this time as to the detailed planning because it is a research business. It is not possible to answer that.

Representative HOSMER. You are going to be able to increase the number of experiments and the variety?

Mr. WILLIAMS. That is right, and modernize the equipment so that it will be right at the forefront of knowledge.

Representative HOSMER. Can you give me any idea in relation to the incerase of the number of experiments, how much would be accomplished here in relation to what would be accomplished by allowing these experiments to be set up by construction of this new engineering building?

These experiments, as I understand it, take a long time to set up. While you are setting them up next to the machine, you have just eliminated that takeoff point from any active experimentation.

If you can cut down that time you vastly increase the use of your machine.

Mr. WILLIAMS. I cannot answer that question exactly because the detailed programing of experiments on a machine like that takes these into account.

My strong impression at Berkeley is that it is something like 5 or 10 percent of the time which might be improved by having this.

But you will never get it down to zero set up time.

So, somewhere in this order of magnitude the setup time would be improved.

That is my personal opinion.

Representative HOSMER. In other words, you will increase the utilization by 10 percent?

Mr. WILLIAMS. That is the sort of top figure I would guess at this moment.

Representative HOSMER. How much would you increase it with these improvements?

Mr. WILLIAMS. That would keep the business going at the same pace.

Representative HOSMER. It would increase the variety of experimentation?

Mr. WILLIAMS. Yes.

Representative HOSMER. But it would not do anything toward increasing utilization?

Mr. WILLIAMS. That is right.

Representative HOSMER. Does not this type of thing again point up the necessity for a staging area for these experiments?

Mr. WILLIAMS. There is no question that it would be highly desirable, Mr. Hosmer. It would be highly desirable.

Representative HOSMER. What did that bevatron cost out there; do you know?

Mr. WILLIAMS. I would like to refer that to Mr. Fields.

Mr. FIELDS. It was about $10 million.

Representative HOSMER. And you could get a 10-percent increase in the use of it for $1.1 million by putting up that building?

Mr. WILLIAMS. That is a rough order of magnitude.

Chairman DURHAM. On project 59–e–2, CP–5 reactor improvements General Fields, why do you put an item in there of $72,000 for heavy water?

Mr. BURROWS. That is just a cost transfer. It is a problem of capitalizing the amount of heavy water. It is a cost transfer from inventory into the building.

Chairman DURHAM. You do not do that with the fuel elements, do you, when you fill a reactor? Why should you do it with heavy water.

Mr. BURROWS. Because heavy water is capitalized and the fuel elements are not.

Chairman DURHAM. I do not see any difference.

Representative HOLIFIELD. Why is this capitalized? Why do we have to ask for appropriations for this?

Mr. FIELDS. We would not ask for an appropriation.

Representative HOLIFIELD. This is just an authorization.

Mr. BURROWS. This is just an authorization.

Representative HOLIFIELD. This comes under that ruling.

Chairman DURHAM. I see that.

Mr. FIELDS. Yes, sir. I think you would want to know the full cost of this if you want to duplicate it.

Chairman DURHAM. At least that is the principle we were carrying forward in the furnishing of heavy water in the reactor demonstration program but I did not know we carried that same principle into our own plants and transfers within our own plants.

Mr. BURROWS. We do the same thing with equipment. If we have equipment on hand we put it in as part of the total cost of the project to be authorized even though it would not be funded.

Mr. FIELDS. This was true of one of the projects previously discussed this morning.

Representative HOLIFIELD. It had equipment in it.

Mr. FIELDS. Yes, sir; which was already on hand. But you need to see the full scope of the authorization.

Mr. BURROWS. For example, the cost of the Savannah River reactors includes the cost of heavy water.

Chairman DURHAM. It may be sound bookkeeping, but it does not make sense to me. We use so much redtape to do these things.

Representative HOLIFIELD. We will go into the field of biology and medicine, project 59–f–1, installations for support of research dealing with radioactive fallout and related radiation hazards.

Mr. FIELDS. I will ask Dr. Dunham to cover that subject, Mr. Chairman.

Representative HOLIFIELD. It occurs to me that we are thinking about work projects and other things which might be accelerated at this time to meet some of the unemployment situation, and it is a little bit disturbing to see all of these important basic research suggestions being minimized and such a small program in the basic physical research projects.

It would seem to me that you have been a little bit timid in asking for things in this field because all this is in the field of construction and utilization of labor and materials. It is probably more worthy than some of the housing projects that may have been presented, particularly at this time in our Nation's history.

Let us go into the biology and medicine side of it, Dr. Dunham.

Mr. DUNHAM. Mr. Chairman, this item of $2 million is related primarily to developing adequate animal-holding facilities for long-term projects, studying the effects of chronic low-level radiation in experimental animals. This has been a limiting factor in some of the work we have been doing in the past.

There are two things that have to be kept in mind.

One is that one has to attach such an extensive animal-holding facility to an institution which is interested in carrying through a 10- or 15-year experiment. Actually one could do a great deal more than this if one could find institutions we would have some assurance would carry through.

This particular sum here involves increasing the animal facilities at the Argonne National Laboratory, at the Los Alamos Scientific Laboratory, at the Davis Campus of the University of California for a planned long-term experimental project in dogs, and at the University of Rochester.

Some of these funds will be used for whole body counters. We need these for two purposes. One is for studies in human beings who, because of accident or, actually, if we can get them sensitive enough, people who just have the normal amount of radioactivity in them such as the radium studies that go on at Argonne National Laboratory for experimental work and in the case of any accidents we should have available, spotted around the country, a number of these whole body counters for emergency use.

Chairman DURHAM. How many do you have now, Doctor?

Mr. DUNHAM. Right now we have about four.

Chairman DURHAM. That is a small number.

Mr. DUNHAM. That is right. We want to expand this greatly, partly on a regional basis and partly for strictly experimental work.

Chairman DURHAM. How many more could you take on with the $2 million you are asking for?

Mr. DUNHAM. These are not terribly expensive items. They run around $30,000 to $50,000.

Chairman DURHAM. But they are terribly important.

Mr. DUNHAM. That is correct. We would hope to build 8 to 10 in the 1959 budget year.

Chairman DURHAM. That would give you enough money to expand it to 12 instead of 4 you have at the present time?

Mr. DUNHAM. That is correct.

Chairman DURHAM. I think that ought to be done.

Mr. DUNHAM. The rest of the money will go for animal-holding facilities.

Chairman DURHAM. That is one way we can determine something by radiation.

Mr. DUNHAM. That is right.

Chairman DURHAM. Do you have trouble getting large enough places at these institutions where you want to carry out the experiments?

Mr. DUNHAM. Not too much. The problem is to get a responsible investigator to assume responsibility for a 10- or 15-year period. We were very fortunate with our large dog project at Utah and we have been very fortunate with the group at the Davis Campus of the University of California.

The Rochester AFC project has now become convinced that they are going to have to hold their animals much longer, too. They are irradiating them constantly for various and sundry purposes and it is just a crime to destroy the animal instead of carrying through.

Chairman DURHAM. You are looking for personnel to take on the job for at least 10 or 15 years?

Mr. DUNHAM. That is right. You cannot hold these for 2 years when you are talking of dogs and swine. We are starting a large swine genetic project at Iowa, a long-term one, so we won't have to rely entirely on mouse data for mammalian genetic information.

Chairman DURHAM. How about cattle?

Mr. DUNHAM. We have not thought about getting into long-term studies on cattle. There is some work that we probably will be supporting possibly in conjunction with the Department of Agriculture and the Federal Civil Defense Administration in farm animals with fission products.

Chairman DURHAM. There are other people doing work in this field besides the AEC at the present time?

Mr. DUNHAM. Yes, there are other people in the field. Certainly most of the financial support, however, comes from the AEC biology and medicine budget.

Chairman DURHAM. The Agriculture Department is not doing any work at all.

Mr. DUNHAM. They have up to now a policy that work with radiation and fission products is to be funded not from their own agency but

by transfer of funds. We have done that with our work on soils and the matter of soil-plant relationship. It has been by transfer of funds. We are setting up, beginning July 1, a very small project trying various engineering approaches to decontaminating a land surface. That again is by transfer of funds.

Chairman DURHAM. Are you far enough along with these other eight in negotiations to say you can do that definitely this year?

Mr. DUNHAM. Very definitely. We had a 2-day meeting which ended Saturday at noon which pretty much finalized how the thing was to be handled.

There is no problem with the counters. The same is true with the animal-holding facilities. They are all on the drawing boards. Actually, some of the plans are finalized and we are just awaiting the funds.

Representative HOLIFIELD. At the conclusion of the fallout hearings last year the committee recommended that you go into an extended program in this field. I suppose this is part of that?

Mr. DUNHAM. That is right.

Representative HOLIFIELD. I join the chairman in thinking that this is quite important and I am glad to see that you are going ahead in this area.

What about your operating budget in this field?

Mr. DUNHAM. The President's budget is $43 million for 1959 which is a considerable increase over the $36 million which we had this year.

The Commission has given us additional funds so we can move along with our expanded program in 1958.

Chairman DURHAM. How about your personnel situation? Are you having any difficulty?

Mr. DUNHAM. My own staff?

Chairman DURHAM. Yes.

Mr. DUNHAM. That is the problem. I think it is a Governmentwide problem because the salary scales at universities and independent laboratories have gone up faster than the salary scales in Government. I do not think we are uniquely involved, but it is a real problem.

Chairman DURHAM. What do you have to pay a good biochemist now or somebody in that classification?

Mr. DUNHAM. A really good one we probably could not compete for such as a full professor at the University of California or Harvard. We can pay around $12,000 a year for a good biochemist. But the university salaries, particularly at the big schools, have gone up to $15,000 and $18,000, and we cannot touch that.

Chairman DURHAM. We ought to try to do something about it. I think this is a very important field. Certainly it is one place in the whole program that we can do something for humanity.

Mr. DUNHAM. What we try to do is to pick younger people who look awfully good. I think they profit by spending a year or two with us. We tend to rotate personnel. They get a breadth of outlook on a field of science that they could not get if they stayed in the laboratory on their own work indefinitely. We are able, that way, to get people to come with us.

Chairman DURHAM. It is not necessary for the same personnel to carry through. Your records are available.

Mr. DUNHAM. That is correct. There is, however, a little lost time because it takes a few months for anybody to get oriented. This is

a policy we have had right from the beginning and I think it has paid off.

Chairman DURHAM. How much money is there in your cancer research program this year, Dr. Dunham?

Mr. DUNHAM. It is $3,700,000. The 1958 budget had $3,300,000.

Chairman DURHAM. It is more than you had last year.

Mr. DUNHAM. Yes. It is a little more. We have not increased it drastically. Next year it will go up because the Brookhaven hospital will open up this September.

Chairman DURHAM. Is that all you can use?

Mr. DUNHAM. I think so. We have not developed the large grant off-site program because of the very big and sound program of the National Institute of Cancer.

Chairman DURHAM. It is an auxiliary and I think it is highly important.

Mr. DUNHAM. It is very important.

Representative HOLIFIELD. You are fairly well satisfied, then, with this $2 million as far as this activity is concerned? You think that is all you will need?

Mr. DUNHAM. I think that is correct, Mr. Holifield.

Representative HOLIFIELD. Let us look at 59–g–1.

Mr. FIELDS. Mr. Hall and Mr. Perkinson.

Representative VAN ZANDT. Mr. Chairman, may we go back to physical research?

Representative HOLIFIELD. Yes, sir.

Representative VAN ZANDT. General Fields, the Pennsylvania State University made proposals to the Commission for assistance for three projects to which the AEC would contribute a total of $877,320 and the Pennsylvania State University a total of $400,000. These projects are a 5½-Mev. vandergraph accelerator and a 30-Mev. linear electronic accelerator to which AEC would contribute $263,000, and a beam analyzing magnet, and the balance of the AEC contribution would go to salaries, supplies, and so on and so forth.

Why did the Commission not include this project in the bill?

Mr. FIELDS. I cannot answer that at the moment, Mr. Van Zandt. I would have to look into it to determine the reason.

Representative VAN ZANDT. Will you get the answer?

Mr. FIELDS. When was that submitted, sir?

Representative VAN ZANDT. It was submitted early this year.

Mr. FIELDS. I would have to review it and provide it for the record.

(The material referred to follows:)

Following is a copy of a letter from the Chairman, Atomic Energy Commission, to the president, Pennsylvania State University relating to the accelerators requested by the university:

FEBRUARY 12, 1958.

Mr. ERIC A. WALKER,
President, The Pennsylvania State University,
University Park, Pa.

DEAR ERIC: This is in reply to your letter of January 29, 1958. I understand that the proposal by the Pennsylvania State University for the establishment of two particle accelerators is presently being given a technical evaluation by the Commission staff.

As the above consideration would indicate, such a proposal is consistent with existing Commission policy. However, I am sure you will appreciate that we receive more proposals of this nature than we are able to support and the Pennsylvania State proposal will necessarily have to compete with others for the

funds we will have available for this type of undertaking. Consequently, I cannot give you any assurances with respect to Commission support at this time. Unfortunately, any final decision by the Commission on these proposals will have to await completion of congressional appropriations for fiscal year 1959, and I do not believe you can anticipate any definite word from us on this before September of this year.

In spite of the above, we are very pleased to hear of your interest in acquiring these accelerators for use in a teaching and research program in nuclear physics and we will make every effort to provide you with the assurances you desire at the earliest possible date consistent with the situation I have described.

Sincerely yours,

LEWIS L. STRAUSS, *Chairman.*

Representative VAN ZANDT. I think the Commission discussed it some time in February.

Mr. FIELDS. It could well be.

Representative PRICE. Mr. Chairman, since we are back on that I would like to throw this question out. Last year I think the budget for the operating of the physical research program was about 71.9 million; is that correct?

Mr. FIELDS. $71.0 million, as I recall.

Representative PRICE. That is right. Do you know whether or not that will be increased this year?

Mr. FIELDS. Mr. Price, the President's amended budget has not been submitted to the Congress. It will be shortly. I believe the Budget and Accounting Act prohibits me from saying what is in it until it is presented. The matters that you have been referring to have been considered by the Commission and I believe the submission will show consideration of them.

Representative PRICE. That might have something to do with the reason why the items that Mr. Van Zandt was talking about were not approved. The level of support would have something to do with that.

Mr. FIELDS. It could be but I still would have to review this one specifically. We are hopeful that the supplemental estimate will be up shortly, sir.

Representative HOLIFIELD. If there are no further questions on basic research, we will go ahead with the project 59–g–1, additional plant for the nuclear training center in Puerto Rico, $500,000.

Mr. HALL. Mr. Chairman, this current fiscal year the Commission has inaugurated the first phase of the establishment of the Puerto Rican Nuclear Training Center. This involved, as you recall, the development of a contract with the University of Puerto Rico to administer the center.

Negotiations are in progress looking for the construction of a research reactor building and associated facilities. It was decided that these units will be located in Mayoguez since the university's engineer- and agricultural college is located there.

The other campus is located in a suburb of San Juan.

The request before you deals with the second phase of our program and specifically with the request for authorization for a medical plant. The medical school is located at the campus near San Juan.

The broad overall objective of developing a rounded program for a regional training center is the reason we are requesting this particular plant.

Dr. Perkinson, who has recently returned from Puerto Rico, is prepared to provide you with any details on the progress of the construc-

tion as well as the particular reception to the program by the Puerto Ricans themselves.

Representative HOLIFIELD. What is the status, Dr. Perkinson, of the $2,500,000 authorized last year?

Dr. PERKINSON. The design and engineering contract for the reactor and building has been let. That money has been obligated to be spent and the design has been made.

The contract for the reactor is being negotiated right now and they expect to let the contract before the end of this fiscal year.

The $300,000 operating cost, or a little over half of that, has been spent so far. They are spending now at the rate of $13,000 a month.

Representative HOLIFIELD. You do not have any equipment there now for training; do you?

Dr. PERKINSON. Yes; we do have.

Representative HOLIFIELD. How many students are you training?

Dr. PERKINSON. The program really got underway before we had a contract there. We had an equipment grant from the Division of Reactor Development to the university itself which allowed them to start their nuclear engineering and training program last summer or last fall.

Soon after that we started a radioisotopes techniques course.

So far they have held four radioisotope techniques courses and will finish up their first year in nuclear science and engineering this summer.

They trained 6 students in the nuclear science and engineering program and have had an average of 13 students in the radioisotopes technique courses so far.

Chairman DURHAM. Is that just a teaching reactor?

Dr. PERKINSON. It will be a teaching and research reactor when it is built.

Representative HOLIFIELD. Does this take the place of the power reactor that was asked for? This is completely different; is it not?

Dr. PERKINSON. Yes; this is completely different.

Representative VAN ZANDT. Mr. Chairman, are the students from Puerto Rico or do they come from Latin America in general?

Dr. PERKINSON. Since the program has just gotten underway, the majority of the students have been from Puerto Rico. This was done intentionally for the first few courses so that they could have a shakedown period to see what their problems were, and to develop their staff and their program. We have already begun to receive a really quite satisfying number of requests from different countries in Latin America for next year.

Representative VAN ZANDT. What countries specifically?

Dr. PERKINSON. We have had requests from Chile, Ecuador, Colombia, Peru, Argentina, Bolivia, Costa Rica, and the Philippines.

Representative VAN ZANDT. Under what terms do they enter the center?

Dr. PERKINSON. They enter the center as regular students of the university. Their qualifications must be passed upon by the faculty with all the other students.

Representative VAN ZANDT. All we are making available here are the facilities?

Dr. PERKINSON. The facilities and staff and operating costs.

Representative VAN ZANDT. Will this eventually become an atomic research center for Latin America?

Dr. PERKINSON. That is one thing that we hope very much it will. Already, in answer to your question about requests, in the last month or so we have had 2 or 3 very interesting requests for research projects for people from outside who want to come there and work in the next year or two. It has really stimulated a great deal of interest.

Representative HOLIFIELD. From South America?

Dr. PERKINSON. These particular requests have been from people in the States.

Representative HOLIFIELD. I thought this was more for the purpose of receiving the Spanish-speaking people.

Dr. PERKINSON. Yes; I think that is true. However, we have to realize that in order to start this project we have had to use people from the States for the majority of the staff positions.

We hope, as the people from South America are trained, they can be brought in.

Representative HOLIFIELD. I was thinking of the students.

Did you mean there were students coming from the United States or just your staff?

Dr. PERKINSON. No. This is just staff and senior level research people. I did not mean basic students.

Representative HOLIFIELD. How many students can you take care of down there when you get this finished?

Dr. PERKINSON. We can take care of about 25 students each session of the radioisotopes course which will be given every other month. So it will be somewhere between 5 and 6 courses a year or around 100 or 125 students.

In the nuclear engineering program they can probably take care of about 15 students per year.

In the health physics program which they expect to start this fall, it will be somewhere around 23 students per year.

Representative HOLIFIELD. The responsibility of those students paying their subsistence and all that sort of thing is on them?

Dr. PERKINSON. Yes; that is correct.

Representative HOLIFIELD. We give them free tuition?

Dr. PERKINSON. No. Actually the students even pay the tuition, or their sponsoring agencies or governments do. It is a regular university tuition.

Representative VAN ZANDT. A moment ago you said all they receive was the benefit of the facilities and the staff.

Dr. PERKINSON. That is correct.

Representative VAN ZANDT. Mr. Chairman, this program that we are talking about, is it in accord with the recommendations of Dr. Milton Eisenhower after visiting this part of the world a year or so ago?

Dr. PERKINSON. Perhaps Mr. Hall can answer this better than I can.

Mr. HALL. Yes, sir. It is in accord with his recommendation.

Chairman DURHAM. Plus a reactor.

Mr. HALL. Yes. The idea for such a center, I believe, was enunciated by Dr. Milton Eisenhower in September of 1956 when the representatives of the Presidents of the 21 Republics met here in Washing-

ton. It was thereafter that the Commission came to you for authorization to proceed on this type of program. We were very fortunate, Mr. Chairman, in being able to procure the services of Professor Bonita from Columbia University, who happens to speak Spanish. He is an American citizen. He will be the project director for the university. That adds emphasis to the bilingual possibilities in the research center.

Chairman DURHAM. Are they doing any research work in biology?

Dr. PERKINSON. The amount of research work that has been done in biology at the University of Puerto Rico itself has really been rather small.

Chairman DURHAM. The university itself has done very fine work in that field.

Dr. PERKINSON. Yes; in agriculture particularly.

They have done a great deal in their school of tropical medicine and in their particular agricultural programs which have to do with tropical agriculture.

We very much expect to have considerable cooperation with the United States Department of Agriculture Experiment Station which is adjacent to the proposed site for the reactor. They are quite interested in cooperating in this project.

Representative HOLIFIELD. The radiation of seeds?

Dr. PERKINSON. I would say that would be one of the things they would be interested in doing; yes, sir.

Representative HOLIFIELD. Unless there is objection, we will tentatively approve that and go on to 59–g–2, International Atomic Energy Agency research, reactor, and laboratories.

Mr. HALL. Mr. Chairman, this item refers to the offer made by the United States Government in October in Vienna. It was a conditional offer, subject to authorization and appropriations, to assist the international agency in setting up facilities and in particular a reactor and associated laboratory.

Since the offer was made, preliminary discussions have taken place with Mr. Cole concerning what the agency might be in a position to receive.

The reason I put it that way is that at the present time the agency itself is simply getting organized and there will be operating costs involved, assuming that you approve and moneys are appropriated.

The situation in Vienna at this time is that Mr. Cole's staff has now prepared the first formal budget which would apply to fiscal 1959, which is the calendar year 1959 for the agency.

Inasmuch as Mr. Cole could not ascertain as to when the formal offer could be proffered and accepted, since it is conditioned on enactment of appropriations, he has expressed the hope to the Commission that the authority granted would be sufficiently broad to allow several courses of action.

I would like to discuss these possibilities just to identify the problem that Mr. Cole has, as well as the problem that the Commission has in being more specific.

The objective of the Director General of the agency is to create a type of laboratory or facility which will be unique.

I think everyone is aware that in Austria itself they are developing a national program and it is quite possible that there will be a swimming pool reactor near Vienna. Mr. Cole does not wish to duplicate

in his own facility something that would be nearby in terms of its utility.

Secondly, there is considerable thought on the part of Mr. Cole's staff that perhaps the best solution to the problem of developing an affirmative program for the beginning program of the agency would be to have a larger installation which would perform unique services which would not be available nearby in Vienna or in Western Europe.

Some thought has been given to a much larger installation which possibly might be a CP–5-type reactor or a materials testing reactor.

In this event, the United States contribution probably would be considerably less than the cost, which would mean that the other governments would have to assist.

Another possibility which Mr. Cole has discussed is that instead of one reactor in terms of demonstrating and identifying agency activity throughout the world, the United States might offer two or three rather small training reactors which could be placed in different parts of the world and this would mean not in Vienna.

Accordingly, when you examine the authorization you will see that it is quite broad simply because in terms of our ability to ascertain the ultimate position, it is still in a planning stage.

I believe, Mr. Chairman, that is about the situation. The agency budget, as such, will be finally reviewed in June and perhaps by that time we will have a better understanding of what would be a sensible relationship with the agency program and, correspondingly, how our offer would fit in to make a definite contribution.

Chairman DURHAM. How many countries have qualified now?

Mr. HALL. I think the number of countries that have ratified is now nearly 60.

Chairman DURHAM. It was 52, I believe, when we were over there. Of course, some of those countries had not passed any atomic energy acts or laws or controls of any kind.

Can you tell us at the present time how many countries have actually adopted an act somewhat along our lines which they were thinking about and talking about when we were over there? At that time Austria had not.

Mr. HALL. That is correct. As a matter of fact, there are two or three countries in Western Europe that are still studying legislation, including Italy and Western Germany.

Chairman DURHAM. Could you get the number for us and put it in the record?

Mr. HALL. I am afraid it would be purely a guess if I answered now.

(Information referred to follows:)

The following countries have atomic energy organizations established by legislative action:

Australia	Guatemala	Republic of Korea
Canada	Japan	Sweden
Denmark	Mexico	Turkey
Finland	Peru	United Kingdom
France	Philippines	

In addition, the following countries have atomic energy organizations that were created by administrative action:

Argentina	Greece	Netherlands
Austria	Haiti	New Zealand
Belgium	Honduras	Norway
Brazil	Iceland	Pakistan
Burma	India	Portugal
China	Indonesia	South Africa
Costa Rica	Iran	Spain
Cuba	Iraq	Switzerland
Dominican Republic	Ireland	Syria
Ecuador	Israel	Thailand
Egypt	Italy	Venezuela
Germany	Lebanon	Yugoslavia

Chairman DURHAM. I think that is a point we should take into consideration and whether or not they are interested enough to come and do something for themselves.

Mr. HALL. Most countries have established a type of law or statute governing the control of uranium, but I would expect that probably not more than half of the countries have developed and passed a statute which would correspond to the type of statute that we have here.

Chairman DURHAM. I was talking to several of them at that time. They were interested in patterning their programs and statutes along the line that we have done in this country.

Mr. HALL. Yes, sir.

Chairman DURHAM. I think it would be important to the committee to know exactly how many have proceeded that far.

Mr. HALL. This is one of the first steps taken by Mr. Cole. He has asked all governments to advise the agency of the statutes, of the various laws, statutes, and decrees affecting atomic energy throughout the world.

I think within a short time you probably will have in Vienna a very up-to-date collection of the existing statutory relationship of atomic energy in each country.

Representative PRICE. Mr. Chairman, for the purposes of the record, I think perhaps we ought to have the history of this offer traced so we will have in the record how this idea generated.

Would you care to do that?

Mr. HALL. Yes, sir.

Prior to the meeting of the first general conference in Vienna, members of the committee, Mr. Chairman—that is, the Joint Committee—acting in their individual capacity, as well as Chairman Strauss, Ambassador Wadsworth, and the American Ambassador to Austria, met in a staff meeting to determine what additional support might seem desirable in connection with the forthcoming meeting in Vienna. It was during that meeting, Mr. Chairman, that the idea of supporting the agency in a way that the agency could have its own facilities emerged, recognizing that a United States offer could not be made except on a conditional basis.

The announcement was made at a press conference by Chairman Strauss, advising that this would be made subject to the authorization and appropriation.

That, generally, Mr. Chairman, was the origin of the idea. I believe that some of the members present were attending that particular informal session.

Chairman DURHAM. One of the questions that was raised most of the time was, What was the agency going to do? Was it going to meet and just listen to scientific papers or was it going to do something fundamental?

One of the questions we raised in some of the discussions where we participated was they should come in and justify the need for the use of these things. We have to have a little more justification for this project.

I hope we can justify the need for this a little more.

Mr. HALL. It is somewhat like the egg-and-chicken problem, because the agency is presently discussing a program which they would hope would embrace the United States offer if approved. The budget, as a matter of fact, will not be finally approved until June.

The objective on the part of the agency, quoting Mr. Cole, is precisely what you have said, Mr. Durham. The agency should be able to make a contribution which is unique and not to be duplicated, and accordingly the United States contribution to that objective should be unique and substantive and useful to the other members of the agency.

Chairman DURHAM. I think the idea was born here in America and it would be a calamity if we let this thing fall on its own face because of the fact that we did not initiate some sound program.

I think we have the responsibility of trying to initiate it.

Mr. HALL. Yes, sir. We have already taken steps to loan staff to Mr. Cole's staff on a temporary basis, at least—in fact the budget itself in its first stage was prepared by one of the Commission staff members. Mr. Cole is going through a very difficult period in the organization.

Chairman DURHAM. I realized that when we were over there.

Representative VAN ZANDT. He took on for himself a job.

Chairman DURHAM. Is the State Department cooperating fully with you in trying to work these things out?

Mr. HALL. Yes, sir.

Chairman DURHAM. They really feel it is an important thing in international affairs?

Mr. HALL. Very definitely.

Chairman DURHAM. I should think it would be right at the top if I had to form any foreign policy at the present time.

Mr. HALL. I can assure you that the staff and the Commissioners are fully behind this.

Representative PRICE. Just to keep the record of the thing historically correct, I would not say that the idea emerged from that meeting. I would say it survived the meeting. It was presented to the congressional group who were invited to this informal meeting.

I recall very distinctly that Members of the Congress present would not place themselves in the position of committing Congress to the program. However, they did not make any objections.

It was presented to the meeting. It did not generate in the meeting.

Mr. HALL. Yes, sir.

Representative VAN ZANDT. Did you say in your opening statement concerning this United States offer that we were to provide maintenance?

Mr. HALL. No, sir.

Representative VAN ZANDT. I misunderstood you.

Chairman DURHAM. As we can understand it, then, this $2 million is really a contingent fund. As far as you know, you may put into existence the present proposal or you may decide to divide it up into several small reactors or into a materials testing reactor to which other nations contribute. There is a possibility that the funds would be transferred to the international agency for expenditure by the agency. Is that right?

Mr. HALL. Yes.

Chairman DURHAM. So it is very tentative.

Mr. HALL. What I am really saying, Mr. Chairman, is that the Commission wishes to make the United States offer as useful as possible and accordingly, given the status of the situation in Vienna, it is very difficult to be more precise. The point on which I wish to assure the committee is that it is the purpose of the Commission to make sure that, when we can correlate the agency's program with the United States offer, we are going to insist that this is done with the greatest utility to the agency and recognition of the United States contribution.

Chairman DURHAM. Has any other country at the present time come in with any concrete proposals at all?

Mr. HALL. No, sir.

Representative HOLIFIELD. They are not very interested in the program.

Mr. HALL. This is the only conditional offer that has been made by any country.

The Soviet Union has offered a series of fellowships in the Soviet Union.

Three or four countries of Western Europe have offered fellowships. We have, too, as you know. But in terms of supporting the agency by moneys which would construct plants this is the only offer.

Representative VAN ZANDT. What about raw material?

Mr. HALL. You mean uranium ore?

Representative VAN ZANDT. Yes.

Mr. HALL. Portugal has offered 100,000 kilograms of U–308. The Canadian Government has offered to sell under uranium contract. I believe that the Brazilian Government and the Indian Government have made references to their willingness to sell thorium.

Representative VAN ZANDT. What about Russia?

Mr. HALL. The Soviet Union has made only one formal offer and that is for 50 kilograms of U–305. We have, as you know, offered 5,000 kilograms.

Representative VAN ZANDT. There were rumors alive in Vienna last fall that Russia would make an announcement of a contribution of a greater amount but it never materialized.

Mr. HALL. No, sir.

Representative PRICE. That is what gave birth to this idea.

Mr. FIELDS. Your previous remark leads me to make one statement, Mr. Chairman. If this were authorized and appropriated, it would not be transferred for general agencywide application. It would be transferred when this project became specific and we knew what it was for.

I just wanted to make sure you understood that.

Representative HOLIFIELD. You would have to wait until you had a program.

Mr. FIELDS. Yes, sir. It would be transferred at the point when we knew what the project was.

Representative HOLIFIELD. You mean to the international agency?

Mr. FIELDS. Yes.

Representative HOSMER. May I ask if this money could be used for nonphysical things? If they decided that the international agency was not going into the business of establishing itself on overhead and it would be used for contracts and fellowships or something like that.

Mr. FIELD. This money would be used only if a project of this nature were to go forward.

Representative HOSMER. It would be a physical project to be run by this international agency.

Mr. FIELDS. Yes.

Representative VAN ZANDT. I think the record should show that it cannot be used for maintenance after the offer has once been accepted.

Mr. FIELDS. Yes, sir. A part is for building a reactor and a part is for radioisotopes laboratory.

Representative HOSMER. Was there much consideration given to the matching factor or condition to go along with it since this is an international agency and you are trying to get other people to go for something so that the funds were made contingent of a matching of some kind?

Mr. HALL. No, sir. The offer in effect is an outright grant for a particular type of objective, as I stated before.

In terms of the United States participation in the agency, the administrative cost up to the present time has been allocated on the same basis as for the United Nations. That is, on the basis of 33⅓ percent. The operational cost, at the present time there is none, would have to be on a voluntary basis. That is the operational cost itself.

Representative HOSMER. Do you have any idea what they would amount to?

Mr. HALL. It would be substantial. Reflecting our experience in Puerto Rico, I would assume that it would be rather close to $900,000 per year.

Representative HOLIFIELD. For our share?

Mr. HALL. No, sir, that would be the total cost.

Representative HOLIFIELD. And ours would be a third of that?

Mr. HALL. The statute of the international agency stipulates that administrative costs should be borne and assessed to the nations on a percentage ratio which up to the present time has been tentatively agreed to correspond to the United Nations percentage, which for the U. S. is one-third. The statute also stipulates that operational costs would have to be on a voluntary basis.

The statute also stipulates that if there are responsibilities to be performed by a laboratory, then those responsibilities can be levied on an administrative basis.

The one clearcut responsibility is the question of maintaining the safeguards and controls over the fissionable material for which the agency, by statute, has the responsibility. So to the extent that this project which we are hoping to develop with Mr. Cole would deal with the responsibility of carrying forth the obligations on safeguards and controls, costs would be levied on a 33⅓ basis. All other operating costs would be on a voluntary basis.

Chairman DURHAM. It is actually funded through the United Nations; is it not?

Mr. HALL. No, sir. It has a separate budget.

Chairman DURHAM. It is the same formula?

Mr. HALL. That is right.

Representative HOLIFIELD. The Director of Personnel and the Director of Training there, are both Soviet citizens?

Mr. HALL. No, sir, the Director of Personnel is Polish.

Representative HOLIFIELD. What has been the record of cooperation with those people? They are in pretty important spots there. Is there a record of cooperation or lack of cooperation with them?

Mr. HALL. I cannot comment with any personal or official experience.

Representative HOLIFIELD. Have you not been over there?

Mr. HALL. I have, sir. I have met the Director of Training. He has been quite cooperative.

On the question of the Director of Personnel, I just do not know.

Representative HOLIFIELD. Maybe you can give us some idea of the number of personnel that have now been hired in this agency.

Mr. HALL. I believe the fiscal 1958 budget, which is the present calendar year, provides for about 350 personnel, which includes all types; that is, the technical personnel as well as the clerks and the stenographers.

To give you a precise figure, I would guess there are rather close to 200.

If I could supply this for the record, I would prefer it.

Representative HOLIFIELD. I wish you would.

(Information referred to follows:)

STAFF OF THE INTERNATIONAL AGENCY

As of April 26, 1958, there was a total Agency staff of 250, of which 94 were professional personnel and 156 were general service personnel.

Representative HOLIFIELD. How many of those are United States personnel?

Mr. HALL. I would have to supply this for the record, Mr. Chairman. There are quite a few. In terms of the entire number I would not hazard a guess.

Representative HOLIFIELD. Would you supply us a list of the salaried personnel in the agency, including a list of the American personnel and their salary ratings? We would appreciate having it.

Mr. HALL. Yes, sir.

(The list referred to follows:)

List of salaried personnel of International Atomic Energy Agency

Title	Name	Country
Office of Director General:		
Director General	Cole, Sterling	United States.
Special Advisor to Director General	Gruber, Karl	Austria.
Special Assistant to Director General	Trapnell, Edward	United States.
Professional officers	Papworth, Mary	Do.
	Schlegel, Otto	Austria.
General service	Schey, Alexandra	Do.
	Stein, Marianne	Chile.
	Doria, Nina	Switzerland.
	Leitsch, Emilie	Austria.
Department for Administration, liaison and secretariat:		
Deputy Director General	Jolles, Paul	Switzerland.
Professional officer	Schiller, Ulli	United States.
General service	Nicoladoni, Eva-Marie	Austria.
	Wiscott, Inge	Do.
	Galimidi, Lucie	Stateless.
	Schaefer, Gerda	Austria.
Secretariat of General Conference and Board of Governors:		
Chief and Secretary of Board of Governors	Bolton, Patrick	United Kingdom.
Interpreters	Bernstein, Alexandre	France.
	Krymm, Rurick	Do.
	Makcheeff, Vera	Do.
Professional officer	Clemann, Rose	Do.
General service	Karlova, Dagmar	Czechoslovakia.
	Ballardie, Eva	United Kingdom.
External Liaison and Protocol:		
Director	Fischer, David	South Africa.
Professional officers	Kazanlev, Vladimir	U. S. S. R.
	Kurino, Othori	Japan.
General service	Bogen, Simono	Switzerland.
	Lavallee, Corina	United States.
	Van Der Valk, Jane	United Kingdom.
Liaison at United Nations Headquarters:		
Director	Galagan, Andrey	U. S. S. R.
Deputy liaison officer	Freeman, Alwyn	United States.
General service	Nicholas, Violet	United Kingdom.
Legal Division:		
Director	Esser, Joseph	Germany.
Senior legal officer	Wattles, Gurdon	United States.
General service	de Haniel, Maria	Austria.
	Reiff, Irene	Germany.
	Barron, Jeanette	United Kingdom.
Public Information:		
Chief	Lind, Lars	Sweden.
Professional officers	Fent, Paul	Austria.
	Napier, Marcello	United Kingdom.
	Flaks, Marco	Switzerland.
General service	Calice, Elisabeth	Austria.
	Arnaud-Foster, Daphne	United Kingdom.
	Gauert, Margarete	Germany.
	Walder, Andrea	Austria.
	Paulitsch, Ingeborg	Do.
Division of Budget and Finance:		
Director	Hamdi, Badr El Din	United Arab Republic.
Senior officer	Hoornweg, Gerbrand	Netherlands.
Professional officers	Van Der Keemel, Dirk	Do.
	Bernert, Hans	Austria.
	Cohen, Mourad	Morocco.
General service	Berger, Kurt	Austria.
	Reisner, Herbert	United States.
	Jakesch, Anton	Austria.
	Baierl, Evelyn	Do.
	Kerschbaumer, Luise	Do.
	Stolzberg, Erika	Do.
	Wenzl, Gertrud	Do.
	Fischer, Eva	Do.
	Kriss, Paula	Do.
	Neiderhofer, Dagmar	Do.
	Rupp, Lucille	United States.
	Skerl, Valerie	Australia.

List of salaried personnel of International Atomic Energy Agency—Continued

Title	Name	Country
Division of Personnel:		
Director	Krackiewicz, Karol	Poland.
Senior personnel officer	Munch-Petersen, Finn	Denmark.
Professional officer	Alder, Walter	Switzerland.
Medical doctor	Brenner, Franz	Austria.
Professional officer	Tatschner, Elfi	Do.
General service	Mueller, Irene	United States.
	Plahl, Maria	Austria.
	de Antal, Herta	Venezuela.
	Blessington, Maire	United Kingdom.
	Burton, Francis	Do.
	Counsell, Eileen	Do.
	Habsburg, Alexandra	Austria.
	Dietrich, Johanna	Do.
	Guillon, Arlette	Switzerland.
	Weber, Christian	Do.
Division of General and Conference Services:		
Director	Sullivan, Donald	United States.
Consulting engineer	Barrett, Arthur	United Kingdom.
Professional officers	Anderson, Eric	Denmark.
	Barrett, Elizabeth	Canada.
	Wolff, Charles	France.
	Nechutny, Lisa	Austria.
General service	Blechner, Beatrix	Do.
	Haller, Johann	Do.
	Kochert, Irene	Do.
	Neubauer, Erwin	Do.
	Willner, Olga	United States.
	Champer, Georgette	France.
	Heel, Franz	Austria.
	Herold, Fritz	Do.
	Jelley, Anthony	United Kingdom.
	Seitl, Helmut	Austria.
	Wieczorkiewicz, Thomas	Stateless.
	Wyckham, San	Do.
	Cheatham, Mary	United States.
	Fürst, Rene	Switzerland.
	Kleiss, Eleanore	Austria.
	Novotny, Fritz	Do.
	O'Dell, Marlene	United States.
	Pachler, Arnold	Austria.
	Peisser, Margarethe	Do.
	Preston, Tatiana	United Kingdom.
	Smolnik, Beatrix	Austria.
	Vesely, Oda	Do.
	Benesch, Edith	Do.
	Brskowsky, Edeltraud	Do.
	Burke, Claire	Ireland.
	Gamauf, Karl	Austria.
	Goldner, Richard	Do.
	Grunspan, Franziska	Do.
	Karwinsky, Hedwig	Do.
	Kotva, Johann	Do.
	Kropf, Ingeborg	Do.
	Matekovich, Frank	Do.
	Meguscher, Maritta	United Kingdom.
	Pick, Susanne	Austria.
	Puaux, Pierre	France.
	Rendi, Peter	Austria.
	Rudeberg, Harold	Australia.
	Schmid, Elisabeth	Austria.
	Sollinger, Manfred	Do.
	Steyrer, Siegfried	Do.
	Süssig, Fritz	Do.
	Takaczy, Margret	Canada.
	Weber, Rudolfine	Austria.
	Fiala, Karl	Do.
	Franz, Edith	Do.
	Fuchs, Anton	Do.
	Gersti, Cecilie	Do.
	Gudenus, Holger	Do.
	Gottmann, Maria	Do.
	Kovats, Lisl	Do.
	Malek, Elisabeth	Do.
	Mayo, Edith	Austria/United Kingdom.
	Michel, Erika	Austria.
	Netzer, Emil	Do.
	Scherer, Marie	Do.
	Skoff, Hilde	Do.
	Tahedl, Michael	Do.
	Wipplinger, Uta	Do.
	Zaufall, Helmut	Do.

List of salaried personnel of International Atomic Energy Agency—Continued

Title	Name	Country
Division of General and Conference Services—Continued		
General service—Continued		
	Arlt, Heimo	Austria.
	Ciapala, Walter	Do.
	Fürhauser, Walter	Do.
	Hiller, Peter	Do.
	Klein, Rudolf	Do.
	Mayo, Eric	United Kingdom.
	Binder, Wilhelm	Austria.
	del Campo, Carlos	Argentina.
	Engleitner, Ehrenreich	Austria.
	Esser, Gerold	Do.
	Haas, Wilhelm	Do.
	Kaiser, Alfred	Do.
	Schaufler, Peter	Do.
	Schlesinger, Leo	Do.
	Uhlir, Max	Do.
Division of Languages:		
Chief	Meana, Luis	Argentina.
Professional officer	Arloff, Harry	United Kingdom.
Translators	Alonso de Huerta, Louis	Spain.
	Derruguine, Michel	Stateless.
	Francois, Jacques	France.
	Hebrard, Marcel	Do.
	Herzberg, Pedro	Argentina.
	Sominsky, Evgeny	U. S. S. R.
	Arzhanukhin, Yuri	Do.
	Bourgaux, Luis	France.
	Carretero, Virgilio	Spain.
	Chaves, Sergio	Argentina.
	de los Cobos, Luis	Spain.
	Combaux, Paul	France.
	Dufrenne, Jean Marc	Do.
	Forst-Battaglia, Roger	Austria.
	Heer, Denise	France.
	Yudinkov, Sergei	U. S. S. R.
	Kashlev, Yuri	Do.
	Kucherenko, Igor	Do.
	Lane, Martin	Ireland.
	Llodra, Miguel	Spain.
	Oteiza-Quirno, Alberto	Argentina.
	Perret, Daniel	Switzerland.
	Plokhotnikov, Fedor	U. S. S. R.
	Poza-Lobo, Higinio	Spain.
	Reading, Raymond	United Kingdom.
	Singer, Esther	Argentina.
	Trepykhalin, Mikhail	U. S. S. R.
General service	Derruguine, Marina	Stateless.
	Paternina, Enrique	Spain.
	Abrakova, Zoia	U. S. S. R.
	Bernhaut, Mildred	United States.
	Caderot, Teodoro	Spain.
	Darricades, Vally	France.
	Ettelt, Irmtraut	Austria.
	Fechter, Mathilde	Do.
	Filip, Alma	United States.
	Galindo, Santiago	Spain.
	Gibert, Pedro	Do.
	Grossmann, Maidi	Austria.
	Larriba, Maud	France.
	Martino, Enrique	Spain.
	Maximova, Valentina	U. S. S. R.
	van Oorschot, Magdalena	Netherlands.
	Pelletier-Doisy, Genevieve	France.
	Piret, Helen	Austria.
	Reinhardt, Marie	Stateless.
	Scheidegger, Maud	Switzerland.
	Vasilieva, Vera	U. S. S. R.
Department of Technical Operations:		
Deputy Director General	de Laboulaye, Hubert	France.
General service	Ball, Elisabeth	Switzerland.
Division of Health, Safety, and Waste Disposal:		
Director	Tait, Campbell C. W	Canada.
Professional officers	Servant, J. Y	France.
	Zaitsev, Victor	U. S. S. R.
General service	Manser, Madalena	United Kingdom.
	Smits, Van Oyen, Luisa	Netherlands.
Division of Technical Supplies:		
Director	Bancora, Mario	Argentina.
Professional officers	Skorov, Dmitri	U. S. S. R.
	Figl, Johannes	Austria.
General service	Locher, Anna Marie	Switzerland.

List of salaried personnel of International Atomic Energy Agency—Continued

Title	Name	Country
Division of Reactors:		
Director	Snizek, Josef	Czechoslovakia.
General service	Eichfelder, Dorothea	Austria.
Division of Economic and Technical Assistance:		
Director	Goswami, Upendra	India.
Professional officers	Dhar, Subhas K	Do.
	Beaumont, Charles	United States.
	Lacko, Rastislav	Czechoslovakia.
General service	Beer, Helen	United States.
	Griesser, Edith	Austria.
Department for Training and Technical Information:		
Deputy Director General	Migulin, Vladimir	U. S. S. R.
Professional officer	Ustinov, Viacheslav	Do.
General service	Viborna, Olga	Czechoslovakia.
Division of Exchange and Training of Scientists:		
Director	da Costa Ribeiro, Joaquim	Brazil.
Professional officers	Grigorieff, Wladimir	United States.
	Seleznev, Mitrofan	U. S. S. R.
	Dosteloe, Kitty	United Kingdom.
General service	Seiler, Gertrude	Switzerland.
	Schleinitz-Prokesch, Maria	Austria.
Division of Scientific and Technical Information:		
Director	Cummins, John Edward	Australia.
Professional officers	Nikitin, Peter I	U. S. S. R.
	Tillette, De Mautort Roch	France.
General service	Stafford, Ursula	United Kingdom.
	Wallace, Elizabeth	United States.
	Aich, Cornelia	Austria.
	Klingsland, Elisabeth	Do.
Department for Research and Isotopes:		
Deputy Director General	Seligman, Henry	United Kingdom.
General service	Coles, Joyce	Do.
Division of Research, Research Contracts, and Laboratories:		
Director	Rostagni, Antonio	Italy.
Professional officer	Vetter, Herbert	Austria.
General service	Davies, Tessa	United Kingdom.
	Gaspar, Adriana	Austria.
Division of Isotopes:		
Director	Fujioka, Yoshio	Japan.
Professional officer	Payne, Bryan Roger	United Kingdom.

List of American personnel hired by International Atomic Energy Agency

Title	Name	Salary [1]
Office of Director General:		
Director General	Cole, Sterling	
Special Assistant to Director General	Trapnell, Edward	$10,000
Professional officer	Papworth, Mary	6,000
Department for Administration, Liaison, and Secretariat:		
Professional officer	Schiller, Ulli	4,800
External liaison and protocol: General service	Lavallee, Corina	[2]
Liaison at United Nations Headquarters: Deputy liaison officer	Freeman, Alwyn	8,750
Legal Division: Senior legal officer	Wattles, Gurdon	8,750
Division of Budget and Finance: General service	Reisner, Herbert	[2]
	Rupp, Lucille	[2]
Division of Personnel: General service	Mueller, Irene	[2]
Division of General and Conference Services:		
Director	Sullivan, Donald	10,000
General service	Willner, Olga	[2]
	Cheatham, Mary	[2]
Division of Languages: General service	Filip, Alma	[2]
	Bernhaut, Mildred	[2]
Division of Economic and Technical Assistance:		
Professional officer	Beaumont, Charles	6,000
General service	Beer, Helen	[2]
Division of Exchange and Training of Scientists: Professional officer.	Grigorieff, Wladimir	8,750
Division of Scientific and Technical Information: General service.	Wallace, Elizabeth	[2]

[1] Salaries listed are those at the bottom of a given grade and are in net United States dollars (i. e. after tax). The Director General has discretion to add up to $1,800 to the normal base pay to compensate for salaries drawn prior to Agency employment. Accordingly, the salaries listed indicate a minimum which may be exceeded, in fact, by up to $1,800.
[2] Salaries for general service schedule not available.

Representative VAN ZANDT. Have they decided to accept the offer of the Government for headquarters on the outskirts of Vienna?

Mr. HALL. No, sir. The present situation is as follows: The Director General felt that the hospital, which you saw, was a little inconvenient and perhaps did not provide for future expansion. The Austrian Government has now offered the Grand Hotel, which was not too far from the Bristol Hotel. The Grand Hotel consists of two parts. There is the refinished part which you saw, I am sure, and an old building which has not been fixed up since the occupation.

The Board of Governors and the Director General are presently considering that building on an extended lease as the headquarters for the agency, which is quite convenient.

Representative VAN ZANDT. Then it will be downtown in Vienna rather than on the outskirts?

Mr. HALL. Yes, sir. It is just about a block from the opera. However, the final decision has not been made. It is still being examined.

Representative HOLIFIELD. Are there any further questions on this item? If not, we will pass this over without any action at this time to take 59-g-3, gamma process development irradiator.

Mr. FIELDS. This is in the amount of $1,600,000 for a process radiator. I would like Dr. Pittman to cover this item for us.

Representative HOLIFIELD. Perhaps you had better give us a little rundown on what this is, Dr. Pittman.

Mr. PITTMAN. Maybe I had better go back in history.

Representative HOLIFIELD. We read the backup material.

Mr. PITTMAN. What we are trying to do is to tap one of the potentially great resources that atomic energy has released, namely, the use of radiation in the industrial fields. For the past 8 or 10 years most of the major industries, chemical, plastics, oil, rubber, and the like, have been studying the effect of radiation on their processes and on the materials they produce. They have been studying, however, on a relatively small scale, using only a curie of cobalt 60 or similar quantities of other isotopes.

However, as a result of this study they have found in practically every one of these major industries I have mentioned that there is a potential use of radiation in their industry.

Representative HOLIFIELD. Is this the sort of thing that the Army Quartermaster is using?

Mr. PITTMAN. The food irradiation is one of the major areas where radiation can be an important factor. This particular installation, however, is not meant to cover the irradiation of food since the Army Quartermaster Corps is adequately covering that phase of it.

Such things as the use of radiation to make new and unique plastics is one possibility.

The use of radiation in polymerization is in the plastic field.

Representative HOLIFIELD. How are you getting along on the polymerization of rubber?

Mr. PITTMAN. As in all of these fields, the problem seems to be that it has gotten to the point where it can be technically done, and the next step is to show what the economics are on a relatively large scale.

So what we are proposing to do here is to build a gamma irradiator using initially cobalt 60 but we want to make it so that it can use other things such as cesium and other available gamma emitters.

We would like to have this facility of a mega curie or two mega curies in size and have it flexible enough so any type of material, whether solid, liquid or gas, can be irradiated on a scale large enough so that we could really get something on the economics on these processes that we know from the laboratory and small-scale work are possible to carry out.

Just as in the case of food irradiation, it was found out what could be done on the individual foods on the small scale and the quartermaster is now trying to find out what can be done on a fairly large scale to get some of the economics of it.

We feel that the cost of going from the small-scale irradiation that industry has been carrying out over the past 8 or 10 years to the large, what you might call, a pilot plant for what we hope is the future industrial applications of radiations is probably much more than any one industry is ready to undertake at this time.

So what we are planning to do is build an irradiator to carry out two types of programs; one is the program that the Commission itself would like to sponsor on the basis of its knowledge of what is going on in the field, and secondly, a facility where the industrialists can come and buy time just as they do in a test reactor for irradiation on a scale big enough to get some technical and economic data.

Representative HOLIFIELD. Something like the Batelle Institute.

Mr. PITTMAN. That is right. It is that type. We have not yet found any evidence that people like Batelle and others are interested at this moment in building such a facility. It may be also that

individual industrial people like in the rubber industry or plastics might build irradiators of their own. But in order to give the complete coverage that we think is necessary to sponsor and stimulate the interest in this field on an across-the-board basis, we think this particular unit is a rather necessary unit. We have not yet said where it would be.

We have a study underway, one of the results of which will be to determine where the facility should go.

Representative HOLIFIELD. Do you have pretty well-developed ideas for the design of an irradiator of this type?

Mr. PITTMAN. I must admit that the ideas we have at this particular moment have to be somewhat flexible. One has not been built yet. We know we need a facility that has roughly the size of 12,000 square feet. We know we have to have a facility into which you can place up to maybe 2 million curies of cobalt or cesium. We know we have to have flexibility. But the engineering design has not been done We have the conceptual ideas of how it should be done pretty well fixed.

Chairman DURHAM. Does that mean it has to be isolated?

Mr. PITTMAN. It has to be shielded. There is no problem of criticality or runaway or anything like that. It is a shielded building. You are handling large amounts of gamma radiation so you need heavy shielding. It does not have to be isolated.

Chairman DURHAM. You people might look at some of these buildings around the country that are vacant. That would save some money. It can be made so it can be fitted for it.

Mr. PITTMAN. The essential thing is the shell of a building and then the shielding can be put inside in almost any type of building.

Representative HOLIFIELD. Are you thinking of using a fuel element here or some of the waste material?

Mr. PITTMAN. This is a facility which will start out using cobalt 60. It will then be capable to switching over to use of some of the separated fission products. We don't plan to use the fuel elements themselves initially, although this facility should be flexible enough to put fuel elements into test before separation of fission products.

One of the things we have definitely in mind is taking the separated fission products like cesium from the Oak Ridge fission product plant and putting it in in place of cobalt. We certainly would want this facility to be capable of using fuel elements as a source of radiation, but they will not be the first to go in.

Representative HOLIFIELD. If you could get a breakthrough in this cold vulcanization of rubber, that would be of inestimable value to American industry?

Mr. PITTMAN. There is a tremendous potential in the rubber field, but it is even greater in the plastic field.

Representative HOLIFIELD. Do you have a complete transformation of the molecules in the plastics?

Mr. PITTMAN. No, sir. One of the major things that it does is to make possible the graft polymerization that you do not get in any other way. You can get pieces of the plastic grafted out to the side. You can get surface grafting.

You can change practically every property of plastic by radiation. You can change its weatherability and strength and practically everything.

Chairman DURHAM. You would get your polymerization much quicker?

Mr. PITTMAN. I am sorry I cannot answer the question on speed. I think you can get it fairly quickly. I am sorry, I just don't recall that.

The advantage of this is that it is all cold irradiation. To date they have shown that a lot of things can be done, but the economics are not known. Industry is certainly extremely interested, but they want a little more information as to whether it is more or less economical than the present techniques. Most of the things we can do with our irradiation can be done in other ways, except right now we know of a few things in the plastic field that can be done only with radiation.

I am sure that once we get a facility like this in being many other new uses will immediately show themselves.

Chairman DURHAM. How about glass?

Mr. PITTMAN. I think there are some potential uses in radiation in glass to change colors and things like that. As of this moment, from the information I have seen on it, it does not look like it is one of the immediate potential uses.

Mr. RAMEY. It will make it darker?

Mr. PITTMAN. Yes.

Representative VAN ZANDT. Have you any projects in the field of bituminous coal?

Mr. PITTMAN. Our whole activity, commissionwise, in the field of utilization of high-level radiation is just starting. It is really the first moneys that we have for this in the 1959 budget. The first thing we are planning, and the only moneys we have ready to move forward with right now in 1958, are for the studies of what the fields of interest are and what can be done in the various fields.

In answer to your question, I know of nothing now.

Representative VAN ZANDT. Do you know of any similar service that now exists as far as free enterprise is concerned?

Mr. PITTMAN. I think you would say that it corresponds somewhat to the service that is apparently being built up in the atomic energy field and is quite closely allied to the service furnished by such companies as GE and Westinghouse and the A. J. Jones Co. when they built the test reactors.

It is a type of service that in ordinary fields, Battle and Armour and some of these other people would furnish.

Representative VAN ZANDT. Are the services of these corporations being used?

Mr. PITTMAN. In this particular field there is nobody else offering this service.

Representative VAN ZANDT. In other words, you are not overlapping or duplicating?

Mr. PITTMAN. No, sir. There is no large-scale radiation service available at this time. We hope there will be. The extent to which we make our facility cover the entire gamut of industry depends entirely on what happens in the next year.

Mr. FIELDS. There certainly has not been any availability in the high intensity field.

Mr. PITTMAN. Industry has done its own in the thousand curie range. For this thing to be important it has to be billions of curies rather than millions.

Mr. RAMEY. Will you have enough cobalt 60 for this irradiator as well as your food-processing irradiator?

Mr. PITTMAN. Yes, sir. The food-processing irradiator is going to require separate production, as you probably know. We will have enough cobalt 60 to go ahead and build this irradiator next year.

Mr. RAMEY. Where will you make your cobalt 60?

Mr. PITTMAN. This irradiator would be made in such facilities as Arco.

Representative PRICE. Is the food-processing irradiator already authorized?

Mr. PITTMAN. That is going to be built with quartermaster funds. All we are doing in the case is offering them the technical service.

Chairman DURHAM. Are they going ahead?

Mr. PITTMAN. Yes, sir.

Representative VAN ZANDT. The reactor project is out?

Mr. PITTMAN. The reactor project is out. They are building a 2 million curie cobalt irradiator with their funds.

Representative PRICE. They will have to get the authorization for that.

Mr. PITTMAN. They apparently already have that.

Mr. RAMEY. Do you have any plans of developing private reactors that would irradiate cobalt?

Mr. PITTMAN. Yes, sir. We certainly hope as the demand for cobalt 60 would grow as the result of this type of activity that the demand would be met for the second and third and fourth charges by private reactors.

Mr. RAMEY. Would you have any kind of program for a demonstration reactor for making cobalt 60 or other products for this purpose to show the economics?

Mr. PITTMAN. This is one of the things we have under study as to the best way we can encourage industry to come in and build the reactors. As of this moment, we do not have a definite plan and I would rather not try to talk about it.

We are trying to figure out the best way of doing this and as yet we do not have them.

Mr. RAMEY. If you wanted to, you could go ahead with a design study for such a reactor or conceptal design?

Mr. PITTMAN. One of the things that we hope would come out of the studies we now are inaugurating is the best procedure to be followed in being sure that industry is the one to furnish cobalt that is needed. Which way we should go, I just do not know right now.

Representative HOLIFIELD. What about the rescission of this item on page 8 of the bill? Project 57-c-6, food irradiation facility, $3 million. As I remember we authorized that 2 years ago.

Mr. FIELDS. That was for a reactor which would be used in the food irradiation facility, Mr. Holifield. Before we reached the stage of building it there was a change in the approach to the problem and the Department of Defense indicated they wished to follow through on a cobalt 60 irradiate or for use with food since they could get it earlier and it was certain. They want to try that before a special-purpose reactor is built.

This is a very special reactor. We are suggesting rescission of that project this year.

Representative HOLIFIELD. So we have no item in this year's bill to take the place of this?

Mr. FIELDS. That is correct. The Quartermaster, as I understand, is going to fund that.

Representative PRICE. Does the AEC agree with the Army that they have taken the proper approach?

Mr. PITTMAN. Yes, sir, I think so. The purpose of this Quartermaster Corps facility is not to prove how you should do it on a large scale, but rather whether you can irradiate food on a reasonable scale and what are the problems of irradiation.

I am convinced that if it gets into a full-scale irradiation program, it will probably not be cobalt but a reactor. To have the problems of building a reactor at the same time you are trying to find out what the problems of irradiated food are seemed not wise.

Mr. FIELDS. They intend to irradiate bulk quantities of food. It is a test of what happens to the food and how good it is on a larger scale than has ever been done at Argonne.

Representative VAN ZANDT. As I understand it, Mr. Chairman, the Army will ask for funds to finance the project through usual military appropriations?

Mr. FIELDS. Either they will ask or they already have it.

Representative PRICE. If they need new facilities I do not see how they could already have it.

Mr. FIELDS. They had some money for this project on their side. It was to be located in California.

Representative PRICE. Sharp.

Mr. FIELDS. Yes, sir. I was just informed they have already transferred funds to us because we will do a part of it, so they have the money already.

Mr. HOLIFIELD. Dr. Pittman, this is your first appearance before the committee since you were appointed as Director of Industrial Development.

Mr. PITTMAN. Yes, sir.

Mr. HOLIFIELD. We want to congratulate you for accepting that position. Would you like to give the record some of your professional background at this time?

Mr. PITTMAN. It is somewhat embarrassing, but I will be glad to do it.

Mr. HOLIFIELD. Do not feel embarrassed at all.

Mr. PITTMAN. I graduated from Vanderbilt in 1936 with a bachelor of chemical engineering, master of science in 1937 in analytical chemistry. I went to MIT and graduated there with a doctor of philosophy degree in inorganic chemistry in 1941.

I stayed on the staff at MIT until 1943 teaching inorganic chemistry and analytical chemistry. Following that, I spent a very short time in Louisville, Ky., with a subsidiary of Corning Glass.

After that I went to Los Alamos in March 1944, and stayed there until 1948 in the plutonium production end of the business out there. I came to Washington in 1948 and started with the Production Division and have been with the various phases of the Commission's program since 1948.

Mr. HOLIFIELD. We are glad to have you before us today and we certainly think that the field you are working in is very important. The committee is very much interested in it.

If there are no further questions, we will tentatively approve this item and go on to the next one, 59–h–1, school storage building, Hanford, Wash.

Mr. FIELDS. The next one I would like to have Mr. Bloch cover.

Mr. BLOCH. This is a $75,000 item to provide a storage facility for the school system out there, replacing some temporary wartime facilities which have been condemned and are about to fall down and at the same time releasing some of the administrative space which the school district requires for the operation of the schools at Richland.

Chairman DURHAM. What is the status of Richland now? I have not been out there for several years. Have they sold the community facilities there, the stores and so forth?

Mr. BLOCH. Mr. Chairman, the program is well along. As you know, it was late getting started at Richland. All of the single and duplex house offerings have now been made. On the basis of the results of the first few groups offered it appears that we are going to have much the same experience that we did at Oak Ridge where the sale of single dwelling units was almost 100 percent.

There is some lag in the duplex units at Richland. I believe the sale of commercial facilities is imminent. There may have been one or two transactions. In addition, the town council and the residents of Richland are pretty actively engaged in studying incorporation.

As you may recall, we have transferred the hospital out there last year to a nonprofit organization. We also disposed of the telephone system last year.

Representative VAN ZANDT. How did you dispose of it?

Mr. BLOCH. The telephone system was sold to the public service company operating in that area.

Representative HOLIFIELD. Ten cents on the dollar, I suppose?

Mr. BLOCH. No, sir. As I recollect we had an independent appraisal made and we got 100 cents on the dollar.

Representative HOLIFIELD. Congratulations.

Representative VAN ZANDT. What was the controversy?

Mr. BLOCH. The controversy was a question of jurisdiction, really, in this service area. One telephone company had been operating in that area and there were claims by others that this particular company did not have a franchise.

However, from the best advice we could get from the State Public Service Commission, this was the appropriate body to dispose of it to.

Representative VAN ZANDT. As I recall it, the State laws were your guideline.

Mr. BLOCH. Yes, sir.

Chairman DURHAM. Do we still have the educational cost burden on our hands?

Mr. BLOCH. Yes. We have had discussions going on with the school district out there and there is a possibility that they may take them over this year. However, we would still be subject to assistance payments under the community disposal bill.

Representative PRICE. Why could you not revert to the federally impacted aid bill on the schools?

Mr. BLOCH. I believe that this is being looked into as one of the ways that they would be given assistance.

Chairman DURHAM. You could certainly qualify if they take over the responsibility for this area.

Mr. BLOCH. I believe part of their funds are coming from that source this year. I can check that for the record.

(The information referred to follows:)

SCHOOL AID, RICHLAND, WASH.

In previous fiscal years funds for the Richland School District have been provided from three sources; the AEC, HEW (under Public Law 874) and from the State of Washington. Beginning with fiscal year 1958, by mutual arrangements between AEC and HEW, AEC payments for the school have been based on the formula contained in Public Law 874, thereby making it unnecessary for HEW to provide any funds. The State of Washington, of course, continues its payments. This arrangement was made in view of the uncertainty as to whether, and over what period of years financial assistance under the provisions of Public Law 874 would continue to be available to the Richland School District.

Representative VAN ZANDT. Are conditions generally quiet now after all the noise that was made while we were trying to write a bill?

Mr. BLOCH. Yes; they are. The programs at both towns have been going well. We have not heard any complaints for some months now.

Representative ASPINALL. For my own education, does the Commission own all of the school facilities out there at the present time and if so, is it contemplated that they will be transferred, and if they are transferred, will it be sufficient to take care of the housing of the pupils?

If they are going to be transferred, when is the transfer likely to be made?

Mr. BLOCH. First, the facilities are all owned by the Commission. The facilities are adequate and as far as we can tell would be adequate for the foreseeable population out there.

Currently, the school system is actually operated under contract with the Benton County School District. Discussions have been going on. There is a possibility, although it is not a certainty, that the school district might take over the schools this year or sometime this summer.

This is still in the discussion stage.

Representative HOLIFIELD. Are there any further questions on this item?

If not, we will tentatively approve it and go on to 59–i, general plant projects, $25,602.

Mr. FIELDS. Mr. Chairman, this is for miscellaneous minor alterations, additions, modifications and replacements to all of the facilities that are operated by the Commission, including our production facilities, research facilities, and community facilities.

This is based on experience factors of previous years. It is for the maintenance and modernization of these facilities which in total are about $6.5 billion in capital investments.

In the case of the operating facilities you will recall the criteria which applies is that no project would exceed $500,000 and would not include a building which exceeded $100,000. In the case of community projects the total individual project would not exceed $100,000 nor any building exceed $10,000.

Representative HOLIFIELD. What is the status of your past authorizations in this field? How much carryover do you have?

Mr. FIELDS. No unobligated carryovers.

Representative HOLIFIELD. Is there something in here for Germantown?

Mr. FIELDS. Something would be applicable here. It would be a small part in the administrative section. If you will look at page 45——

Representative HOLIFIELD. That is where I am looking, $937,000 for community.

Mr. FIELDS. Anything in Germantown would be in the administrative program, which is $400,000.

Representative HOLIFIELD. What are you spending in Germantown in the way of community?

Mr. FIELDS. Nothing.

Representative HOLIFIELD. In your administrative, this does not include your bus fund?

Mr. FIELDS. No, sir; it does not.

Representative HOLIFIELD. What does it include?

Mr. FIELDS. Minor items. Equipment shelter, retention bases, shelter areas for the headquarters, minor modifications to the building if necessary.

Representative HOLIFIELD. How about hotel facilities in the lobby?

Mr. FIELDS. No, sir; these estimates are based on experience factors of previous years. This has been a most essential part in keeping our large facilities operating efficiently.

Representative HOLIFIELD. I notice you have close to $17,000 in special nuclear materials and weapons.

Mr. FIELDS. $17 million.

Representative HOLIFIELD. Yes; I am sorry. I apologize for talking in such a small amount. Give us an idea what this reactor development is in here. What is that fund for?

Mr. FIELDS. It would cover items of minor construction in all of the facilities. It could be minor process improvements. For instance, I have a list of some tentative projects here that one would have in mind. They include a central shop facility north of building 20 in Chicago, $50,000; and reactor water recirculating pump installation at Argonne.

Chairman DURHAM. This would apply to all of the reactors from the standpoint of modifying them and changing them?

Mr. FIELDS. Yes, and all of our operation plants. There would be small additions of this nature. They are clearly needed. They met the criterion.

Chairman DURHAM. There are no new reactors included?

Mr. FIELDS. No, sir. There are no new reactors or reactor experiments that would be covered in this project.

Chairman DURHAM. What is the difference between your physical research amount there and the million that we have just had in a separate project?

Mr. FIELDS. Those two projects each had $500,000.

Chairman DURHAM. These are separate?

Mr. FIELDS. These are separate. Those projects came to $500,000 so they did not fall in the criterion of $500,000 for general plant items. That is the limit for which we ask specific authorization for the project. Below $500,000 there are items of this nature such as the interim low-level analytical laboratory at Oak Ridge of $47,000, and a high-level manipulator cell for a building at Oak Ridge, $107,000 esti-

mated. These are just examples of the kinds of projects which are being done in 1958.

There is also the conversion of a space in a research building to a double dark room at Ames, Iowa.

Representative HOLIFIELD. Can you break down all those items in the record?

Mr. FIELDS. I can only give you the sort of things that would come up during the year. This is by no means a complete list of the kind of things that would be done.

Representative HOLIFIELD. Break that down and give us examples because some Member on the floor might question the same item, physical research here for $1.5 million and the other is physical research.

Mr. FIELDS. Yes. Some of it is fairly definitive. You have to recognize it is subject to review and they might or might not go ahead depending on the availability and the urgency of the projects.

(The material referred to follows:)

Examples of general plant projects under the physical research program in the fiscal year 1958

	Thousands of dollars
Oak Ridge:	
Facilities for consolidation of Physics Research Building 4500, ORNL	177
Salvage-yard facility, ORNL	86
Transfer pipelines between Buildings 3019, 3505, and 3517, ORNL	69
Security measures for declassification of ORNL areas	55
Dry-storage facility for irradiated materials, Building 3025, ORNL	59
Modifications to multicurie fission products pilot plant, ORNL	70
Interim low-level analytical laboratory, Building 0907, ORNL	46
High-level manipulator cell, Building 3029, ORNL	107
Design thorium oxide-processing facility, ORNL	174
Replacement and improvements to cell air-exhaust system, Building 3019, ORNL	128
Ames: Conversion of space in research building to double darkroom	24
Washington headquarters: Time of flight path, Columbia University	124

Representative HOLIFIELD. Let me announce that tomorrow morning at 10 a. m., we will have an executive meeting in room F–88 for classified projects. Thursday at 10 a. m., continuation of the executive meeting and if we finish that, we will get into some unclassified projects.

May 23, Friday, 10 a. m., and 2 p. m., we will have hearings on the Carolina project, the Elk River, and the Piqua.

Mr. FIELDS. And there will be no hearing Wednesday.

Representative HOLIFIELD. If there are no further questions on 59–i, we will give it tentative approval and go to the next item.

Section 108, expenses for the move to new principal office, $210,000. You have some backup on page 46.

Is there anything you want to give us on that?

Mr. FIELDS. Mr. Chairman, this is an increase, really. You authorized $75,000 last year. This is a requested increase of $135,000 to make the total $210,000.

Early this year we instituted bus transportation on a subsidized basis to the Germantown headquarters. It has been most helpful in insuring the continuity of the operations of the agency. We started out with, I believe, 16 lines. It is now down to 10.

We are reducing as we go along. However, we are faced, as you know, when we complete the additional wing authorized—with 240

people who are still at H Street. These people would be moved to Germantown on completion of the wing. We will be faced with some problems for a short period in the transportation of those personnel. We would hope that the Congress could see fit to authorize this for an additional year so that we could go forward in supporting transportation for one more year of the staff that utilizes these buses.

Chairman DURHAM. Do you feel that you would lose many of your personnel in case we did not continue this operation of the buses?

Mr. DERRY. Yes; we feel we would. The indications that we had from the personnel before the move was that the most important factor in moving out to Germantown was adequate transportation.

Then, we attempted during November and December to do this and in doing this we entered into seven bus contracts. The seventh contract was for the guards' bus. We have now discontinued that one. The 6 contracts have been reduced to 5 and provide, we think, adequate transportation.

Some of the people have gone into car pools and some have moved out. It has given the impetus for the transitional change. This is the important factor.

Chairman DURHAM. You made your contract with the bus companies on a 12-month basis, did you not?

Mr. DERRY. It is cancellable on a 30-day basis.

Chairman DURHAM. Are they charging the same as when they started out?

Mr. DERRY. The same as they started except that there have been some buses for which we have had to extend the routes. One started out to be about a $45-a-day bus, and it is now about a $52-a-day bus because we have had to extend one route from Georgia Avenue and Alaska out into the northeast of Maryland in order to be able to consolidate another route.

Chairman DURHAM. What percentage of personnel did you actually lose by moving out there? Have you tried to determine that?

Mr. FIELDS. I think the turnover went up slightly but not very much.

Mr. DERRY. That is right.

Mr. FIELDS. It is very critical in the secretarial area.

Chairman DURHAM. The low salary level?

Mr. FIELDS. Yes, sir.

Chairman DURHAM. That is quite an expense to go out there every day.

Mr. FIELDS. Yes, sir.

Chairman DURHAM. What does a ticket cost for a round trip?

Mr. FIELDS. $1.00.

Chairman DURHAM. That is $22 a month off their net salary.

Mr. FIELDS. They are paying that.

Chairman DURHAM. I know, and we are subsidizing some of that.

Mr. DERRY. We pay the difference between the dollar and what it costs to run the buses. We have also tried to find out what the existing contract carrier would do under commercial operation. It is not very encouraging. The Virginia and Southeastern buses said that they would not want to try it at all. It is too far to go for a reasonable rate. The D. C. Transit Co. said they would charge at least $1.25 one way. The only transit carrier that has a franchise to Germantown has a published schedule of 75 cents from 15th and K.

Chairman DURHAM. How much is the subsidy per round-trip ticket?

Mr. DERRY. An average of about 40 percent of the cost of the published tariff. The gross cost of operation has been running at about $17,000 a month and the net cost after we deduct the bus tickets has been running about $10,700.

Chairman DURHAM. Is this a direct operation of the Commission or is it by contract?

Mr. DERRY. This is by contract. We have contracts with Suburban Transit Co., District of Columbia Transit, A. B. & W., W. V. & M., W. M. & A.

Chairman DURHAM. How do you work that on the basis of allowing a profit? Do you allow them a certain percentage of profit?

Mr. DERRY. No. We invited proposals from all of the carriers in the area that would be interested, and they all expressed an interest in the business, and then we separately negotiated with each one for his independent territory. We got the cost-per-day operation down to what we thought was a reasonable basis and then we entered into contracts for daily operation.

Chairman DURHAM. How many miles out is it?

Mr. DERRY. It is 27 miles from the middle of town.

Chairman DURHAM. It is roughly 50 miles a day round trip and the total cost of that ticket is $1.40?

Mr. DERRY. Yes.

Chairman DURHAM. So it is less than 3 cents a mile?

Mr. DERRY. Yes.

Chairman DURHAM. I would say that is about as reasonable as it could be run. I don't see how they can run it on that basis.

Mr. DERRY. We have a bus that runs to Damascus that costs only about $10 a day. The one in Virginia costs us approximately $75 a day. This is a round trip.

Representative HOLIFIELD. Are there any further questions on that? If not, we will tentatively approve it. Let us take the rescission.

Section 107. The first one is the fabrication plant, $5 million. We might have something for the record on that. 58–B–1.

Mr. BLOCH. Project 58–B–1 was an authorization for a fuel element fabrication plant having in mind an approved method of fabricating certain elements. The basis for this project was strictly one of possible economics or savings. This new process offered promise of paying for itself by outright savings in dollars. The development work has not borne this out.

Meanwhile, we have made progress in reducing costs in the method we are currently using. This project is being deleted strictly on the basis that the potential economics that we thought we might gain just cannot be realized.

Chairman DURHAM. What about the Fernald, Ohio, plant?

Before you go into that, however, on that plant, is any private enterprise doing that type of work at all?

Mr. BLOCH. No, sir; not this.

Mr. FIELDS. We do contract with certain private industry for some fabrication.

Chairman DURHAM. I know you do. I mean on this particular item.

Mr. BLOCH. No, sir.

Mr. FIELDS. As I recall, this seemed to be very promising.

Chairman DURHAM. I thought we had a contract with somebody, and we were going to cancel the whole thing all of a sudden. That is what I was concerned about.

Mr. BLOCH. No, sir; 58–B–3 is really in the same category. Again, this looked promising, from the standpoint of reducing cost, but further work indicated that it just wouldn't pay its way.

Mr. RAMEY. It does not mean a change of the kind of slug?

Mr. BLOCH. Actually, this had to do with a method that we were using at St. Louis that worked very well there. We thought at the time this project was requested that it would work as well at Fernald, but, due to the different operating characteristics and some other factors, it is not economical to put it in at Fernald.

Representative HOLIFIELD. How about some backup on the next item, project 58–E–13? We received a letter dated May 16, 1958, from the HEC on this and I will insert it in the record at this point.

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., May 16, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: This is to inform you of the Commission's decision to discontinue work on project 58–e–13, Argonne boiling reactor (ARBOR), which was authorized in Public Law 85–162 at $8.5 million.

You will recall that this project was planned as a flexible boiling water test facility to provide technical information for use in the design of large central station powerplants. Based on further studies by the Argonne National Laboratory, including preliminary design by United Engineers and Constructors, it has been determined that the flexible facility required to accomplish all of the objectives of the project would cost $13.5 million. This increase in cost and the revised authorization which it necessitates resulted in a revised schedule calling for completion in fiscal year 1961 rather than fiscal year 1960 as originally scheduled.

The project has been reevaluated taking into consideration the effect of schedule delays on the value of the project and the fact that there is competition with other high-priority projects for the additional funds needed for its construction. This reevaluation has resulted in the decision to discontinue the project. It is accordingly being withdrawn as a part of the Commission's request for authorization in fiscal year 1959.

Sincerely yours,

LEWIS L. STRAUSS, *Chairman.*

Mr. FIELDS. That is an item to which I referred in my opening statement. I could ask Dr. Davis to elaborate on it.

Mr. DAVIS. The ARBOR is a project initiated by Argonne a little over 2 years ago, and studied by them, and seemed like a worthwhile way of exploring the boiling-water reactor. It was authorized last year, for a total of $8.5 million. However, further studies by Argonne have shown that the cost of what they would consider to be a really usable facility would be something of the order of $13.5 million. In the meantime, there has been very great success with the boiling-water reactor at Argonne, and with the series of borax experiments at Idaho and the General Electric Company at Vallecitos.

Our feeling, which I believe is shared by the Laboratory, is that, by the time this is built, it will not, in terms of other boiling-water reactors then operating, make as significant a contribution as it would have if it had been started a year or more ago, and this is a project which, although it still might be somewhat desirable, we feel is probably not worth pushing forward with at this time.

27254—58——11

I might say that Argonne has become quite interested in the subject of superheating steam from boiling-water reactors and is now turning their people who have been working on ARBOR over to this, and I understand they are very enthusiastic about this and think this is a very profitable line for the Argonne Laboratory to pursue.

Chairman DURHAM. So, there is nothing to take the place of this particular item in the 1959 budget.

Mr. DAVIS. There is nothing to take its place. The people, themselves, are working quite profitably in the field of superheating the steam.

Chairman DURHAM. Do they need anything in the way of a facility for the superheating?

Mr. DAVIS. Not at the present time.

Chairman DURHAM. They can take care of that in the existing facilities?

Mr. DAVIS. This may ultimately result in building an experimental superheater on the borax experiment, or something of this sort.

Chairman DURHAM. Did you fund any of that project last year at all?

Mr. DAVIS. There has been work done on it in the way or architect-engineering.

Mr. FIELDS. $8.5 million was appropriated, but it has not all been spent. A half million has been spent on the design work.

Chairman DURHAM. Do you actually have the $5 million and $850,000 in the other 2 projects? Have they all been financed?

Mr. FIELDS. The $8.5 million was appropriated.

Chairman DURHAM. I mean appropriated.

Mr. FIELDS. The $8.5 million was appropriated. That will be applied to the 1959 budget.

Mr. TOLL. I notice that these 3 last items recommended for rescission add up to $14,500,000. Would the Commission be agreeable to reducing the amount authorized in section 101 of last year's act by that total amount?

Mr. FIELDS. I am not sure I follow the import.

Mr. TOLL. All this would do is rescind the authority to proceed with certain projects, but would not reduce the total amount authorized.

Mr. MCCARTHY. I think, Mr. Toll, where we have had increases in projects or rescissions in past bills, that it would not affect the total. We have such a situation in sections 107 and 108 of the 1958 authorization bill.

Mr. TOLL. On the contrary, Mr. McCarthy, when there was an increase, for example, $35 million for the destroyer reactor plant, the total amount was increased. But when there are rescissions it is usually not suggested that the total amount be reduced.

Mr. MCCARTHY. I don't think we have any problem with it. The difficulty, as we pointed out in the past, is where we obligated some of the money. In this particular case, we think, there is about $0.5 million.

Chairman DURHAM. You will have a problem with the Appropriations Committee if you don't rescind it.

Mr. MCCARTHY. They look to the item, and the rescission can be followed.

Mr. TOLL. Would you have any objection to reducing the total amount or not?

Mr. McCarthy. I think there would be no objection if we could identify any obligations made. In the particular case of Arbor, we can identify about $500,000. There is an architectural-engineering contract which is presently being canceled. What the cancellation costs will be we really don't know at the moment.

Mr. Holifield. I think, in general, the Commission is to be commended for canceling projects on a conservative basis. By that I mean that I do not think the Commission should lose face of any of these projects which we start in this exploratory field, such as this fabrication plant for $5 million, if the time comes when you think it is wise to cancel it and rescind it, I think you should have no hesitancy in coming before the committee and just stating that developments have passed or even saying we have made a mistake in this line and we have now found a better way, rather than see you persist on a project because it happened to be authorized and appropriated for as a line item.

Are there any further question?

Mr. Fields. There is one other rescission, and we spoke of that. That is the food irradiation.

Mr. Holifield. That has been covered.

Then we will adjourn at this time, and we will meet at 10 o'clock in the morning in the committee offices for an executive session for some classified matters.

Subsequent to the hearing, AEC furnished, at the request of Subcommittee Chairman Holifield, the following revised estimates for starting dates of projects included in the proposed 1959 authorization bill. The following data on AEC coal consumption was similarly furnished subsequent to the hearing.

U. S. Atomic Energy Commission—Starting dates of projects in proposed authorization bill for fiscal year 1959

Project number and title	Previously submitted	Revised estimate
59-a-1. Plant modifications for processing of nonproduction spent fuels, undetermined sites.	July 1958	3d quarter, fiscal year 1959.
59-a-2. Pilot plant for fabrication of new fuel elements, Fernald, Ohio.	October 1958	2d quarter, fiscal year 1959.
59-a-3. Reduction of fire hazards, phase II, gaseous-diffusion plants, Oak Ridge, Paducah, and Portsmouth.	July 1958	1st quarter, fiscal year 1959.
59-a-4. New waste-storage installations, Arco, Idaho	do	2d quarter, fiscal year 1959.
59-b-1. Weapons production and development plants, locations undetermined.	October 1958	1st quarter, fiscal year 1959.
59-b-2. Component fabrication plant, Hanford, Wash	August 1958	Do.
59-b-3. Fabrication plant, Oak Ridge, Tenn	do	Do.
59-b-4. Special processing plant, Mound Laboratory, Ohio.	January 1959	3d quarter, fiscal year 1959.
59-c-1. Storage site modifications, various locations	August 1958	2d quarter, fiscal year 1959.
59-c-2. Base construction, Eniwetok Proving Ground	July 1958	1st quarter, fiscal year 1959.
59-c-3. Base construction, Nevada test site	do	Do.
59-c-4. Test area development, Nevada test site	do	Do.
59-c-5. Phermex installation, Los Alamos, N. Mex	September 1958	2d quarter, fiscal year 1959.
59-c-6. Laboratory building, TA-33, Los Alamos, N. Mex.	July 1958	Do.
59-c-7. Test and environmental installations, Sandia Base, N. Mex.	September 1958	1st quarter, fiscal year 1959.
59-c-8. Lineal acceleration tester, Livermore, Calif	do	Do.
59-c-9. Test assembly building	do	Do.
59-c-10. High explosive development plant, Livermore, Calif.	do	2d quarter, fiscal year 1959.
59-c-11. Storage and handling building, Livermore, Calif.	do	Do.
59-d-1. Reprocessing pilot plant, Oak Ridge National Laboratory, Oak Ridge, Tenn.	July 1958	1st quarter, fiscal year 1959.
59-d-2. Special-purpose test installation	October 1958	2d quarter, fiscal year 1959.

U. S. Atomic Energy Commission—Starting dates of projects in proposed authorization bill for fiscal year 1959—Continued

Project number and title	Previously submitted	Revised estimate
59-d-3. Fast reactor safety testing station, Nevada test site.	August 1958	1st quarter, fiscal year 1959.
59-d-4. Army reactor experimental area (AREA), Arco, Idaho.	October 1958	2d quarter, fiscal year 1959.
59-d-5. Hot cells	do	1st quarter, fiscal year 1959.
59-d-6. Army package power reactor No. 2	July 1958	2d quarter, fiscal year 1959.
59-d-7. Modifications to organic moderated reactor experiment (OMRE), experimental boiling water reactor (EBWR), and boiling reactor experiment (borax).	Fiscal year 1959	1st quarter, fiscal year 1959.
59-d-8. Heavy water component test reactor	do	Do.
59-d-9. Fuels technology center addition, Argonne National Laboratory, Illinois.	April 1959	3d quarter, fiscal year 1959.
59-d-10. Gas-cooled power reactor	March 1959	Do.
59-d-11. Project Sherwood plant	July 1958	1st quarter, fiscal year 1959.
59-c-1. Accelerator improvements, University of California Radiation Laboratory.	October 1958	Do.
59-c-2. CP-5 reactor improvements, Argonne National Laboratory, Illinois.	July 1958	Do.
59-f-1. Installations for support of research dealing with radioactive fallout and related radiation hazards.	do	Do.
59-g-1. Additional plant for the Regional Nuclear Training Center, P. R.	December 1958	3d quarter, fiscal year 1959.
59-g-2. International Atomic Energy Agency research reactor and laboratories.	October 1958	4th quarter fiscal year 1959.
59-g-3. Gamma process development irradiator	January 1959	3rd quarter, fiscal year 1959.
59-h-1. School storage building, Hanford, Wash	September 1958	1st quarter, fiscal year 1959.
59-i- . General plant projects	July 1958	Do.

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., June 11, 1958.

Mr. JAMES T. RAMEY,
Executive Director, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. RAMEY: The following data is submitted pursuant to your telephone request to the AEC Congressional Liaison Office for information on AEC coal consumption for the fiscal year 1958 as compared to United States total consumption.

Bituminous coal

	Tons
AEC direct procurement, fiscal year 1958	1,902,507
AEC indirect procurement for power, OVEC, TVA, EEI, fiscal year 1958	[1] 18,030,000
Total AEC direct and indirect bituminous coal	19,932,507
Total United States consumption, calendar year 1957, bituminous coal	[2] 413,619,000

Anthracite coal

Total United States consumption, calendar year 1957	[2] 21,000,000

[1] Estimated.
[2] Latest yearly data received from the Bureau of Mines. Anthracite tonnage estimated by Bureau of Mines as 1957 report has not been published.

We will be glad to furnish such additional information as may be required.

Sincerely yours,

J. R. BRUNDEL
(For John A. Derry, Director, Division of Construction and Supply).

(Whereupon, at 4:10 p. m., Monday, May 19, 1958, the subcommittee was recessed, to reconvene at 10 a. m., Tuesday, May 27.)

AEC AUTHORIZING LEGISLATION

TUESDAY, MAY 27, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to call, at 10 a. m., in room 457, Senate Office Building, Hon. Chet Holifield, chairman of the subcommittee, presiding.

Present: Representatives Holifield, Durham (chairman of the Joint Committee), and Price, and Senators Bricker, Hickenlooper, and Dworshak.

Also present: George E. Brown, Jr., staff member; N. R. Nelson, staff technical consultant, Joint Committee on Atomic Energy; and Bernard V. Dvoskin, GAO Consultant.

Representative HOLIFIELD. The subcommittee will be in order.

This is a continuation of the hearings by the Subcommittee on Legislation on the 1959 AEC authorization bill. This morning the subcommittee will receive testimony on several large-scale accelerators which have been proposed for inclusion in the Commission's physical research program, including those proposed by the Midwestern Universities Research Association, MURA, and by Stanford University.

It might be noted at this point, for the record, that the MURA project was discussed in some detail last February by the Research and Development Subcommittee during its public hearings on the Commission's physical research program. At that time the committee was privileged to hear the expert views of Dr. Keith Symon, a leading member of the MURA group, who described the research work being conducted by the MURA in connection with the proposed accelerator.

We are happy to welcome here today Senator Wiley of Wisconsin, who has asked to appear before the subcommittee to present a statement in support of the MURA project. I understand that appearing with Senator Wiley, at his request, will be Dr. Symon, Dr. Crane, and Dr. Rollefson of the MURA group, who are present to provide detailed information on the project.

We also have present with us today the General Manager of the Atomic Energy Commission, who will make a brief statement on the Commission's large accelerator program, including the Stanford and MURA proposal, and members of the AEC Division of Research who are present to assist in answering any detailed questions which may arise.

Representative HOLIFIELD. General Fields, you may lead off and as soon as you conclude your testimony and Senator Wiley arrives, we will be glad to have him testify.

STATEMENT OF K. E. FIELDS, GENERAL MANAGER, ATOMIC ENERGY COMMISSION

Mr. FIELDS. Thank you, Mr. Chairman. I do have a brief statement. Before I read it, I might say that the support of research in the country, and in the Middle West in particular, has always been of great concern to the Commission, and it is to me personally, too.

I might just for your information advise you that I am from the Middle West and I spent 3 years at the University of Illinois at one time. I have still a very close association with the Middle West myself. I hope to go fishing there sometime this summer.

I have a very brief statement, Mr. Chairman. I believe there are copies for the committee and others here if they wish them.

High energy physics research represents one of the important frontiers in nuclear science. The advent of the multi-billion-volt accelerator has already produced scientific information indicative of the great possibilities of this type of physics research.

In the short 6 years since the billion-volt mark was first breached here in the United States, by the Brookhaven cosmotron, such important contributions as the production of antinucleons and the discovery of the nonconservation of parity have been made by the research associated with these large machines.

There are at this time in the Commission's program 4 multibillion-volt accelerators, the largest of which is the Berkeley 6.2-billion-volt bevatron. Other machines are at Brookhaven, Cornell University, and the California Institute of Technology. However, the Commission realized that if this country is to stay in its present position of technical leadership in the high energy physics field, it would be necessary to build new accelerators of higher energy and greater intensity.

Consequently, we presently have under construction 4 new large accelerators; 3 of these new machines are proton devices:

The high intensity 3-billion-volt synchrotron which is being constructed jointly by the Princeton University and the University of Pennsylvania;

The 12.5-billion-volt synchrotron at Argonne National Laboratory;

And the 25-, 30-billion-volt alternating gradient synchrotron at Brookhaven National Laboratory.

This last machine, which is expected to go into operation in 1960, will give the United States the largest particle accelerator in the world. One other machine is now under construction, namely, the 6-billion-volt electron synchrotron which is a joint effort of Harvard University and the Massachusetts Institute of Technology. This machine will increase the maximum energy presently obtainable in accelerated electrons by a factor of five.

These machines, although major steps forward, may have to be augmented by even larger machines in the pursuit of studies of the ultimate nature of the nucleus. Consequently, the Commission has been pursuing a program of development of new accelerator techniques. The preliminary design of two possible new accelerators has come out of these efforts.

One of these is the proposed 2-mile-long, 45-billion-volt electron linear accelerator which is under design at Stanford University; the

other one is the proposed fixed field alternating gradient synchrotron now under development by the Midwestern Universities Research Association.

The Commission has supplied financial support to both of these groups, which has helped to make possible these design efforts. Thus the Commission has invested about $2,500,000 for support of the MURA design effort. The present rate of support is about $1,100,000 per year.

These funds have been utilized to study the ideas of the MURA group by means of computer calculations and models of possible accelerators. Two such models have been constructed and a third model of the novel two-way FFAG accelerator is now under construction. It is expected that this last model will clarify many questions on the technical feasibilty of the proposed clashing beam machine.

The Stanford design effort has been supported both by the Office of Naval Research and the Atomic Energy Commission. We have had a contract with Stanford University for general linear accelerator and klystron development since 1953. The annual level of this contract has been about $200,000. At this time, definitive proposals for the construction of these two machines are in hand and are under technical review.

It must be realized that it will be an expensive effort to sustain our high standards in high energy physics. We estimate that support of full utilization of accelerators, those now in operation or now under construction, will cost about $50 million per year by fiscal year 1962.

Our first efforts should be directed toward supporting the large technical and monetary investments we have made in existing machines, by making it possible that they can be used to their maximum capability. To provide the even more advanced tools will also prove to be quite expensive. Thus the construction costs of the MURA and Stanford accelerators, as listed in the proposals, are 86 and 87 million dollars, respectively. On the basis of past experience and trends, these estimated costs may be low.

Furthermore, one has to remember that each one of these machines, when completed, will require operating budgets which will have a magnitude of 15 to 20 million dollars per year.

At the present time, we have specific proposals for accelerators from both Stanford University and MURA under technical review. In parallel with this review, we are initiating architect-engineering cost analysis studies to determine more accurately the reality of the construction cost estimates of both of these projects. When the scientific and engineering reviews are completed, we will be in a much better position to determine the future procedure. We are not now planning to request authorization of either of these projects in fiscal year 1959. We have not requested authorization of these projects in fiscal year 1959.

Representative HOLIFIELD. Thank you, Mr. Fields.

At this time I will ask the AEC witnesses to stand by and we will hear from Senator Wiley.

Senator Wiley, we are happy to have you before the committee this morning, and we are glad to hear from you.

STATEMENT OF HON. ALEXANDER WILEY, A UNITED STATES SENATOR FROM THE STATE OF WISCONSIN

Senator WILEY. Thank you, Mr. Chairman and gentlemen of the committee. I am grateful for this opportunity.

My purpose is simple: I am here respectfully to recommend that you direct the Atomic Energy Commission to reexamine immediately its decision which was, unfortunately, not to request the authorization of funds for the construction of the high-speed accelerator near Madison, as recommended by the Midwestern Universities Research Association.

In my judgment, if the Atomic Energy Commission refuses to reconsider its position, the result will be a national tragedy.

I could amplify that. I think Lyndon Johnson made a speech yesterday about how backward we are. The New York Times recently has published an article showing where we are moving or not moving. I say I use my words very carefully.

This is an age such as the world has never seen. Columbus was a pioneer in exploration. But the possibilities of atomic exploration are even greater.

Now, why will it be a national tragedy if AEC does not reconsider?

I often think of the difference between what the world is now and what it was when I came down here just 20 years ago. The world was big. We knew very little about the atom. Since then we have had the atom bomb, the hydrogen bomb, and now we are delving into the mysteries of nature, finding new forces, yes, new continents, as it were, in the world of matter.

Why would this be a national tragedy, to sit on our haunches?

First, competent observers believe that the United States is now behind—I stop—behind the Soviet Union in high-speed physics experiments. That is dangerous business, Mr. Chairman.

Second, the outcome of our race with the Soviet Union for research in high-speed physics may well affect the future capacity of the United States to be supreme in nuclear warfare or defense.

Three, the loss of 12 to 18 months in going ahead on the MURA project will mean that the gap between ourselves and Russia, instead of being narrowed by us, will become even wider—to our disadvantage.

Four, and we will have lost 12 to 18 months of precious opportunity to train the brilliant minds of young American citizens.

Now, gentlemen, I do not presume to be an expert in science as a whole, or on this MURA project in particular. I am only a layman. I have tried, however, to be alive in this age of challenges, to examine the key issues. I have discounted from my own thinking the fact that this project might be well established in my own State.

As far as I am concerned, the issue is not where it will be built, but when it will be built, and whether it will be built in the freest possible atmosphere of a university, where you have minds that explore and reach out to understand the meaning of life and the meaning of these new things and new forces as against the more closed atmosphere of a Federal laboratory.

Here in this room you have present before you the three men who knows this project best. Dr. Rollefson and Dr. Symon and Dr. H. R.

Crane. They are prepared, and are qualified, to answer any technical question which you may wish to put to them.

Before they begin their testimony, I would like to insert in the record, if I may, brief thumbnail sketches of these gentlemen.

Representative HOLIFIELD. The sketches will be included.

[From American Men of Science, the physical sciences]

Crane, Prof. H(orace) R(ichard), University of Michigan, Ann Arbor, Mich. Physics. Turlock, Calif., Nov. 4, 07; m. 34; c. 3. B. S., Calif. Inst. Tech., 30, Ph. D. (physics); 34. Research fellow, physics, Calif. Inst. Tech, 34–35; instr. and research physicist, Michigan, 35–38, asst. prof. Physics, 38–42, assoc. prof. 42–46, Prof 46– Research assoc., Mass. Inst. Tech., 40; dept. terrestrial magnetism, Carnegie Institution, 41. Consultant, Nat. Defense Research Cmt.; director Manhattan Dist. research projects, Michgan; U. S. N., Office Sci. Research & Develop., 42–45. A. A. fel. Physical Soc. Nuclear physics, high energy accelerators, electronics; biophysics, artificial radio-activity, radio-carbon dating.

Rollefson, Prof. R(agnar), Dept. of Physics, University of Wisconsin, Madison 6, Wis. Physics, Chicago, Ill., Aug. 23, 06; m. 36; c. 4. B. A., Wisconsin, 26, scholar, 26–27, M. A., 27, Ph. D. (physics), 30. Asst. Physics, Wisconsin, 27–30, instr., 30–36, asst. prof., 36–42, assoc. prof., 42–46, Prof., 46–, Chairman Dept., 47– Mem. staff, radiation lab, Mass. Inst. Tech. 42–46; chief scientist, naval research lab, Boston, 46; Proj. Charles, Mass. Inst. Tech., 51, Lincoln lab., 51–52. Fel. Physical Soc. Continuous spectrum of mercury vapor; radar; infrared dispersion of gases.

Symon, Dr. Keith R(andolph), Wayne University, Detroit 1, Mich. Mathematical Physics. Ft. Wayne, Ind., March 25, 20; m. 43; c. 4. S. B. Harvard, 42, A. M. 43, Ph. D. (theoret. physics), 48; Maryland, 45–46. Instr. Physics, Wayne, 47–48, asst. prof., 48–53. Assoc. Prof. 53– U. S. N. R. 44–45. Physical Soc.; Asn. Physics Teachers; Asn. Symbolic Logic. Design of ultra-high frequency radio equipment; theory of energy loss fluctuations of fast particles; statistical communication theory; computing machinery.

Although all three of these gentlemen are officials of MURA, Dr. Rollefson being Director, Dr. Symon being Technical Director, and Dr. Crane being President of MURA, Dr. Crane is at the University of Michigan and professor of physics there. He is, therefore, in a position to speak as an outsider about the work which has been going on at Madison, Wis.

I may say that these gentlemen have not come down here on their own initiative. Had it not been for my personal requests, they would not be here today. They have never wanted to become involved in a controversy. They believe in working closely with the AEC. But they are here at my request, because they sense, as I do, the crucial factor of time. They are here to provide information to the committee. I said they are scientists. They can give you information. I cannot. I hope their statements will serve to correct some of the misstatements and misunderstandings which have gained currency about the MURA program.

The strength of the MURA technical group and the scientific contribution it has made have been amazing. This is particularly true in view of the fact that only for a few months of its existence, from November 1955 to May 1956, has the MURA group seemed to have an assured future. It is fortunate that, in spite of this uncertainty, it has held so many of its key people. That is a very important thing, Mr. Chairman.

This is no different from anything else that you and I know in human existence. When you have a team that works together and has been assembled for a definite purpose and then you disintegrate it, you have a job on your hands again. However, MURA's hold on

its key people will not continue, the team will not stay together, much longer unless something is done.

You now have the opportunity to give assurance to the future of the MURA group.

Gentlemen of this committee, you have heard it many times before, but it is nevertheless true, time is of the essence. I remember back, and I have mentioned it many times, in 1941 when the Army and Navy and Air Force and America were asleep. Pearl Harbor came upon us like a thief in the night. Had we been alert and awake, we could have saved a hundred billion dollars in wealth, tens of thousands of lives, and 2 years of war.

Instead of that, we sat back complacent. In the opinion of men in the Senate and in the House and elsewhere, we are in a far more serious situation now than we were back in 1941. The world has moved on, and it has moved into new phases of human knowledge.

If the Joint Committee on Atomic Energy chooses not to direct the AEC to reexamine its position, then 1958 is lost, and 1959 is lost. The very earliest the project could possibly be authorized would be mid-1959. And work would probably not be commenced until the start of 1960. Even if the authorization is given now, the machine cannot be completed until 1963 at the earliest, and some say 1966.

Is there anyone in this room who could say with assurance that the loss of these 18 months would not be significant, in terms of our technical race? Instead of calling it merely technical, let us call it a race of life and death with the Soviet Union, as some have said.

Last October, Professor Crane said on his election to the presidency of MURA:

> We can regain the lead in this high-energy physics if we can forget the idea that we cannot afford it, and if we act quickly. Such a machine as MURA proposed would cost about $100 million, and would require 8 years to build. But it would make possible discoveries in physics in a range we have not yet entered. What the physics of the super energy range will lead to in the next decade or two, we cannot even imagine, but we would like to be the first to find out. This is the kind of research that looks far into the future. We must not forget that the "high-energy physics" of the twenties and thirties culminated in the release of atomic energy.
>
> In times when the Nation is worried, as it is now, there is a strong tendency for the Government to pour its resources into "crash programs" that will give short-range results, and to curtail basic, long-range research. Basic science in this country has been suffering from this policy, and acutely since sputnik. Congress should realize we are not in this race for a matter of months, but probably for decades. It should support the agencies that are responsible for our scientific future so they can be ready for the challenges before they come, not after.
>
> Shortly after the Geneva Conference on atomic energy in 1955, at which Russian scientists boasted of their 10-BEV accelerator, the United States Atomic Energy Commission announced its intention to finance a super accelerator that would insure our position for at least 10 years. The urgency was short-lived, and financing for construction of such a machine never materialized. The AEC has supported the model studies, however, and this contract has just been renewed.

Now back to the issue of allowing the status quo to continue—a status quo of uncertainty as to MURA's future—perhaps, a status quo of 18 months.

Is there anyone in this room who could dispute the fact that a delay of this kind might well prejudice the safety of the United States?

Let not future Congresses look back upon this date and say, "If only the Joint Committee on Atomic Energy had seized the initiative and insisted that the AEC revise its position. If only more precious time had not been lost."

MURA is ready to go ahead.

Last February, Dr. Symon testified before the Subcommittee on Research and Development as follows:

Representative PRICE. Dr. Symon, do you believe that you have done enough development work up to this point, that if you were given the go-ahead signal on the full-scale accelerator you would be in a position to start immediate detailed design work?

Dr. SYMON. Yes, sir; I think we would.

Representative PRICE. That would indicate then, that a failure to get approval of the proposal at the present time is the only thing holding you back.

Dr. SYMON. Yes, or at least it begins to hold us back if it is delayed very much longer.

Representative PRICE. With respect to the full scale accelerator that you hope to have some day, would that be the concept of the two counter-acting beams within the same tube?

Dr. SYMON. Yes, sir.

Gentlemen, the MURA project may be a theory. And yet, it is a theory grounded in reality. The working model for MURA works. The scientists who built that model are among the best in the land. To authorize a green light for them is to save money, not waste money.

I urge, therefore, that you give favorable consideration to a mandate to the AEC, directing that it reconsider its position.

Now, as I said, gentlemen, we have these three gentlemen here who I have asked to come down. I hope they will be privileged to testify and that you folks who have been right in the midst of this and your experts will really give them a once-over, a cross-examination that will bring out the facts and what this research machine may accomplish and can accomplish.

Let me conclude by saying that I am very sensitive to the timeliness of things. Many a job has misfired because it has not been started in time. We are in a battle for our very existence with the Kremlin because of its great scientific advance. And I think that this is the judgment of a good deal better men than I am. And as stated yesterday by Lyndon Johnson, and as I said was outlined also in the New York Times and other papers, it is conceded that in these vital respects we are lagging.

Can we as legislators, as virtually the custodians of the future of America, "lay down" on accepting the challenge that is here before us?

I trust that you will hear these gentlemen and I know you will then come to the conclusion that, I believe, America needs.

I thank you.

Representative HOLIFIELD. Thank you very much for your testimony, Senator Wiley.

We are now prepared to hear the gentlemen from the MURA group if they will come forward at this time.

Senator WILEY. I now present, Mr. Chairman, Dr. Rollefson and Dr. Symon and Dr. H. R. Crane. Dr. Rollefson will give a statement first and then be open to cross-examination.

Representative HOLIFIELD. You may proceed, Dr. Rollefson.

STATEMENTS OF R. O. ROLLEFSON, KEITH R. SYMON, AND H. RICHARD CRANE, PRESIDENT, MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION

Mr. ROLLEFSON. As Senator Wiley has pointed out, we are here at his request to supply information to the committee regarding present status, plans and needs of the MURA Laboratory.

As you know, we have recently revised our proposal for a high energy research facility, originally submitted to the Atomic Energy Commission April 1956, to incorporate the results of the theoretical and experimental investigations which have been carried out at the MURA Laboratory during the last 2 years. The revised proposal has been sent by the Atomic Energy Commission to about 50 scientists for review and this review will probably be completed sometime in June.

We were somewhat reluctant to appear before the Joint Committee at this time because of the possibility that our appearance might be misinterpreted. However, our program has been so misunderstood and statements have been published which are so confusing or misleading that we felt we should not pass up this opportunity to set the record straight.

The original MURA proposal described an accelerator which achieved colliding beams by means of two accelerator rings tangent to one another. Investigations since then have confirmed that this accelerator would perform as predicted in the proposal.

However, it has been discovered that it is possible to make two beams circulate simultaneously in a single accelerator ring, thus achieving colliding beams in an essentially simpler manner. It now appears that this is the preferable way to construct a colliding beam accelerator and consequently this type is described in the revised proposal.

In the course of the MURA investigations, two models have been built which have tested and confirmed all of the principles involved in the MURA proposal. A third model is now under construction which will do with electrons on a small scale essentially all of the things which we propose to do with protons in the large accelerator. This model should be completed within the year.

During this next year we intend to exploit the third model to the fullest possible extent to make sure that its behavior is in strict accord with the theory on which the proposed large accelerator is based. At the same time, we expect to continue with design calculations for the large machine and we hope to be able to construct models of actual components for the proposed accelerator; for example, models of the magnets and the accelerating mechanism. We have been encouraged to believe that the AEC will provide funds to support these activities.

Senator BRICKER. On the basis of that statement, Doctor, you have not yet come to a final conclusion except as to the first model?

Mr. ROLLEFSON. We have two models which demonstrate that the principles on which we are basing the accelerator are valid. The third model will actually model with electrons exactly the thing we want to build.

Our theoretical people are so confident in their principles and the way they are applied that some of them feel that the third model is unnecessary, but we realize that this is a very large investment and so the third model will be useful, we are sure.

Senator BRICKER. Senator Wiley mentioned that there has been delay and that this committee ought to move this faster than it has gone. Has there been any delay up to the present time that the Atomic Energy Commission could have corrected?

Mr. ROLLEFSON. Yes, I believe there has been. As a matter of fact, this third model should have been completed perhaps last summer. But the organization was in danger of disappearing entirely last summer.

Our understanding was that our support would cease after September 30, 1957.

Senator BRICKER. Where did that information come from?

Mr. ROLLEFSON. I think it was absence of any information to the contrary that was perhaps primarily responsible for this. I think if you would ask the Atomic Energy Commission people, they could give a more accurate statement.

Senator BRICKER. Was that due to the appropriation here?

I had not heard at any time that the MURA program was not going ahead and was not going to be completed, or that there was any lack of interest in it on the part of the Commission. I think that Mr. Fields' testimony here confirms that this morning. It may have been slower than it should have been or than we wanted it to be.

Mr. ROLLEFSON. Perhaps the reason for delay was that about the first of 1956 it became very doubtful that support would be continued. At least the MURA people were led to believe this.

Senator BRICKER. By whom?

Mr. ROLLEFSON. By conversations with representatives of the Commission, as I understand it.

Senator BRICKER. Who were they?

Mr. ROLLEFSON. I did not take part in these conversations myself. I think Dr. Williams, who is now with the Commission, was our president at the time.

Senator BRICKER. General Fields, do you know of any time when there was any thought of giving up this MURA program?

Mr. FIELDS. Senator Bricker, as I recall, it was a question of continued support and the question of where it would be done. There was a review of what would be done in that fiscal year. What was that date that you indicated?

Mr. ROLLEFSON. September 1957.

Mr. FIELDS. This was under review and it was somewhat indefinite for a term.

Senator BRICKER. There is no question about it now, then.

Mr. FIELDS. There is no question about it now. It was supplied then consistent with the program and it did go forward.

Senator BRICKER. That is what I wanted to clear up.

I have also a vital interest from another side of this.

Mr. ROLLEFSON. Shall I proceed?

Senator BRICKER. Yes, go right ahead, Doctor. Thank you very much.

Mr. ROLLEFSON. If we can proceed without unnecessary delays, we should be able to order major components such as iron by early 1961 and complete final assembly during 1963. That is perhaps an optimistic schedule, but it is a possible one, I think.

At the moment, however, we have no prospect of maintaining this schedule. One of the first requirements for doing so would be to

begin construction of a laboratory building almost immediately. The garage which we are now using as a laboratory is barely adequate for the model work and component development that we have scheduled for the present year, and will be totally inadequate to continue the program beyond another year. We will therefore need a laboratory building ready for occupancy a year from now.

It goes without saying that we cannot build a laboratory without a place to put it, and this furnishes the first reason why th question of site, on which there has been unfortunately so much misrepresentation and misunderstanding cannot be postponed much longer.

Senator BRICKER. Who is responsible for that confusion in regard to the picking of site?

Mr. ROLLEFSON. It is difficult to assign responsibility. The stories which have appeared in the press have had errors in them that have misled people, I am sure. They were not intentional errors.

The story of how the site was picked was mixed up when it was reported to the press.

Senator BRICKER. You have 15 universities here that are interested in this program?

Mr. ROLLEFSON. Yes.

Senator BRICKER. Are they to pick the site?

Mr. ROLLEFSON. When we were asked by the Commission to design and build the finest accelerator in the world, the understanding was that a site should be chosen which would be mutually agreeable to the universities and the Commission. On account of that charge, the universities appointed a site commitee which then looked into the matter.

I have an explanation of that later, if that is all right.

Senator BRICKER. That is all right. I will not anticipate that at all.

The responsibility of picking the site is primarily up to the universities or the representatives in MURA?

Mr. ROLLEFSON. When you say "is," I do not know if I can agree.

Senator BRICKER. They have to pick a site and one that is agreeable to the Commission representatives?

Mr. ROLLEFSON. This is my understanding.

Senator BRICKER. That was my understanding. Have they been able to pick that site yet?

Mr. ROLLEFSON. Yes, indeed. Within a few months of the time, we were asked to go ahead, the member universities had chosen three sites, all of which were considered satisfactory to recommend to the Commission. The members had arranged these in order with the one at Madison, the overwhelming favorite. There has never been any deviation from this.

Senator BRICKER. Has the Commission agreed to that?

Mr. ROLLEFSON. No.

Senator BRICKER. They have not done anything on it yet?

Mr. ROLLEFSON. That is correct.

Senator BRICKER. What is the reason, then, that the commission has not moved on accepting the site or asking for another?

Mr. ROLLEFSON. I have an outline of this.

Senator BRICKER. I do not want to anticipate what you have. Go right ahead, Doctor, and we will get to that a bit later.

Thank you very much.

Mr. ROLLEFSON. A second reason for urgency in settling the site question is that the final plans for the accelerator cannot be drawn until the site is known, and until very careful studies of the geological characteristics, load-bearing qualities, et cetera, have been carried out. Such studies could well occupy a period of a year or more. One could not think of asking an architect to design a building without telling him where it is to be built, and yet the design and performance of a large scale accelerator depend much more sensitively upon the geological characteristics of the site.

Finally, it is necesary to settle on a site for the sake of the personnel who are to construct and operate the accelerator. Present and prospective employees are justifiably very much concerned with knowing where the project will ultimately be located. Since so much incorrect information has circulated regarding the choice of a site by MURA, a short review of the actual procedure would probably be of interest.

Chairman DURHAM. Who circulated that kind of information? Who was responsible for circulating that information? You say misrepresentation and misunderstanding.

Mr. ROLLEFSON. I could get out a number of clippings which have incorrectly stated the situation regarding the site.

For instance, one statement, that there had been continual bickering about site, is completely incorrect. I want to correct that now.

Chairman DURHAM. Who is responsible for that?

Mr. ROLLEFSON. This is very hard to put on any one person, it seems to me. I do not even mention the name of the person who was listed in the newspapers because I am sure he was just told it by someone else and was repeating it. He did not have direct contact.

Chairman DURHAM. I am thinking about if such information came from a Government agency. I think we should clear that matter up.

Did it come from them or did it come from newspaper reporting?

Mr. ROLLEFSON. This matter of bickering about site was in a press conference of the Atomic Energy Commission a few months ago.

Chairman DURHAM. It did come from the Commission, then?

Mr. ROLLEFSON. Yes, it did. I am sure it was an unintentional error on their part. Unfortunately, however, it appeared in newspapers all over the country, and as those things go, they never get corrected.

Senator BRICKER. Is this a fight whether this should go to Argonne or go to Wisconsin?

Mr. ROLLEFSON. I dislike calling it a fight. There is disagreement as to what is the best procedure.

Senator BRICKER. What were the other two sites picked by the representatives of MURA?

Mr. ROLLEFSON Purdue and Minnesota.

Senator BRICKER. So I am absolutely neutral. I can approach this from the position of accelerating the program regardless of site. I do think they ought to be able to get together with the Commission on a site. The Commission insisted upon this being located at Argonne.

Mr. ROLLEFSON. This has been our impression.

I again have another paragraph that will state it more carefully than I can do it extemporaneously.

Representative PRICE. If I may, Senator, I think I can develop a little the question of Argonne versus the university site. I think

the Commission has quite a problem to study there, particularly since supporting facilities are involved. The Commission is thinking of supporting facilities that must go around the machine. So there is some justification for the Commission being very careful in consideration of the location of the accelerator.

Is that not true, Dr. Symon? The Commission's caution because of the many supporting facilities that would surround the machine, is not without reason.

Mr. ROLLEFSON. That is certainly one of the principal points. There is hope that some economies can be realized by placing the accelerator at an already established site.

Representative PRICE. In your statement you say one of your first requirements is to build an administration building?

Mr. ROLLEFSON. A laboratory building.

Representative PRICE. You say one of your first requirements would be to begin construction of a laboratory building almost immediately?

Mr. ROLLEFSON. Yes.

Representative PRICE. The Commission would probably argue that they have the laboratory available at Argonne.

I am not making any justification for one side as against the other, but I can see some justification for the Commission's position.

Mr. ROLLEFSON. I would agree there are certainly some points. We think there are other points that more than compensate.

Representative PRICE. I am not arguing the point. I am throwing this out for the information of the committee as to what is involved.

Senator HICKENLOOPER. As a matter of fact, Doctor, is not one of the major and important questions involved here that it be virtually the creation of a second national laboratory with duplicating facilities that already exist at Argonne and at a cost of tens of millions of dollars, when we already have the facilities at Argonne? I am just inquiring.

I have no choice necessarily in this matter. There is a matter of a lot of extra millions of dollars involved here.

Mr. ROLLEFSON. I think this is a very important point and I would like to speak to it right now. The facilities at the Argonne which would be applicable for an accelerator laboratory of the type we envision seem to us to be rather minor. The Argonne Laboratory is primarily a reactor laboratory. Most of the expensive facilities there are pointed toward use of the reactors and development of reactors. These facilities are not applicable to an accelerator laboratory and we think it would not be wise to reproduce them in the neighborhood of the accelerator. There is no particular connection.

The total cost of the installations at the Argonne, as I understand it, is about $80 million. It seems to me that no one in his right mind would advocate reproducing that whole installation in the neighborhood of one of these high-energy accelerators. The total savings that might be made by building the accelerator near the Argonne, we believe are more than compensated by the reduced cost of the foundation in building the accelerator on a sandstone base which is available at any one of the three sites advocated by MURA.

The Atomic Energy Commission actually made an investigation of this point and allowed a certain amount for facilities already available at the Argonne, allowed a certain amount for less expensive

foundations in the neighborhood of Kegonsa and the two costs came out almost identical.

It is true that other departments in the Argonne might be interested in being in the neighborhood of an accelerator, but we think this is a relatively minor interest.

Representative HOLIFIELD. Is there some peculiar advantage in the base you are speaking of?

Mr. ROLLEFSON. The foundation?

Representative HOLIFIELD. Yes.

Mr. ROLLEFSON. In hunting for a site, we had the advice of a number of the best foundation engineers in the country. I think the consensus of opinion was that an accelerator could probably be built almost any place, but since the tolerances were so severe—for example, the motion of the magnet should not be more than of the order of a hundredth of an inch relative to other magnets that might be as far away as a quarter of a mile—it was foolish to invest so much money on anything but a bedrock base. The type of bedrock which was best for the purpose was sandstone rather than limestone.

All three of the sites proposed by MURA have sandstone foundations, and at a level which is easily accessible.

Representative HOLIFIELD. And this is not true at Argonne?

Mr. ROLLEFSON. The situation at Argonne, as I understand it, is that there is a particular place where bedrock is available. It is limestone. The danger in limestone is that there might be caverns in it that would make it unstable.

At this particular place, I should say I know of no evidence that there is any cavern formation in the rock. But it is a little doubtful that the area is great enough to take care of the accelerator we would like to build. This has not been explored in great detail.

Senator BRICKER. How close to the university is the site that has been picked in Wisconsin?

Mr. ROLLEFSON. It is just about 8 miles. It takes 15 minutes in a car.

Senator BRICKER. How far from Madison?

Mr. ROLLEFSON. I would guess 5 miles from the city limits. The city does not extend very far in that direction yet.

Representative HOLIFIELD. You may proceed.

Mr. ROLLEFSON. Dr. Symon reminds me that there is an additional expense at the Argonne in that the rock is so far down—of the order of 50 feet—that it is more difficult to excavate and build a machine.

I will begin with a review of our site survey here in order to be sure that I state the things that I wanted to call to your attention.

When in November 1955 MURA was asked by the AEC to design and construct the world's finest accelerator, a site committee was set up which made a very careful and thorough investigation of possible sites in the Midwest. This committee had the help of some of the foremost foundation exports in the country. All of the member universities were invited to suggest sites and 11 proposals were received, some of them containing more than 1 possibility.

After a thorough study of the proposals, the committee made an independent investigation of the most promising possibilities, and finally reported back to the MURA board.

On the basis of the report of the committee, the advice of the technical group, and independent study of the proposals, the members of MURA chose three of the proposed sites for submission to the Commission for consideration. Of the three, the site near Madison was the overwhelming favorite of the Mura members and was so reported. This has continued to be the position of the MURA universities on the matter of site.

Senator BRICKER. All the universities will have the same access to the facilities and the same use?

Mr. ROLLEFSON. Absolutely. It is our intention to make a very strong effort to see to it that it is a joint program and that all of them are represented in it.

The criteria which were important in the selection of site varied somewhat from member to member. However, there were a few which were of major importance and of these the nature of the foundation was probably first. For an accelerator of the type proposed, the magnets must be kept in place to about one-hundredth of an inch in a circle nearly one-fourth of a mile in diameter.

The advice of all authorities was that bedrock, preferably sandstone, was so superior to other possibilities that it would probably be very unwise to gamble with anything else. All three of the recommended sites conformed to this requirement.

A second criterion was proximity to a university and to a university community. It was appreciated that some of the principal ties which hold outstanding men in the universities; in spite of more remunerative possibilities elsewhere, are their enjoyment of associations with faculty and students in the university, the advantages of raising their families in a university community, and the presence in a university of library and research facilities, outstanding scholars, and a variety of activities encompassing all areas of human knowledge.

The controversy regarding site which has been impeding progress for the last few years can perhaps be described as follows:

The MURA scientists feel that, having developed the principles of the new accelerator, they are the logical group to design and build it if one is to be built. The AEC, on the other hand, believes that the project is of such a magnitude that it ought to be carried out by an existing national laboratory and therefore proposes that it be built at the Argonne Laboratory.

However, there does not appear to be any practical way of building the accelerator at the Argonne other than for MURA to give up its operation of the project and the Argonne to organize a group to carry on the work. On this both the AEC and MURA are agreed.

Although it is probable that under these circumstances some of the present MURA personnel would transfer to jobs at the Argonne, the MURA people feel that this would involve a considerable loss of time and momentum, as well as loss of competence and morale in the group. Furthermore, such a policy would in the future discourage the formation of other groups for the purpose of developing new ideas.

An additional point on which there has not been complete agreement involves the organizational structure of the laboratory. The MURA position is that an instrument of this type to be used for pure basic research can most easily and efficiently be built and most effectively be used if it is operated by the cooperating universities as a university research laboratory. This is a principle which has been found

successful at the Brookhaven Laboratory which is operated by the Associated Universities, Inc., a group of eastern universities.

The MURA organization has been patterned after the eastern AUI organization. It is our hope to make use of Brookhaven's experience in order to improve where possible upon this organizational concept.

We believe that an organization in which each university has both responsibility and authority is most likely to make full use of the scientific potential of the universities.

During the 5 to 10 years that the accelerator would be under construction, the MURA organization would be able to draw upon the large pool of scientific talent represented by the universities throughout the Midwest.

The universities involved are all of the Big Ten universities: Iowa State College, Purdue University, Michigan State University, Northwestern University, University of Chicago, University of Illinois, State University of Iowa, Indiana University, University of Kansas, University of Michigan, University of Minnesota, University of Notre Dame, University of Wisconsin, the Ohio State University, and Washington University of St. Louis.

This includes all of the Big Ten universities and five other large and active universities in the region.

Chairman DURHAM. Doctor, can you give us the number of personnel actually involved from each university, or a total number?

Mr. ROLLEFSON. In the technical group at the moment.

Chairman DURHAM. I am talking about the technical scientific group involved in carrying on the project.

Mr. ROLLEFSON. I could not reel them off and get all of them.

Chairman DURHAM. If you do not have it, will you supply it for the record?

Representative PRICE. I think Dr. Symon testified before the Research and Development Committee that you have about 40 or 50 scientists now working on the project.

Mr. ROLLEFSON. Only some of those are in residence right now. Some are working at their own universities.

Representative PRICE. I mean they are involved in the MURA project.

Mr. ROLLEFSON. Yes.

Representative PRICE. Is that about right?

Chairman DURHAM. What I am trying to get at is that we spent about $2½ million on this project by supporting the group so far.

Mr. ROLLEFSON. Yes.

Chairman DURHAM. Have you reduced the personnel or are you spending the same amount of funds at the present time?

I understand it is being continued. It has not been dropped?

Mr. ROLLEFSON. That is correct.

Chairman DURHAM. What did you start out with?

Did you start out with 40 or 50 and how many do you have today?

Mr. ROLLEFSON. We started out with a small number, I would guess of the order of 15.

Chairman DURHAM. You can supply the information for the record or probably the Commission can supply it.

General Fields, do you know how many people we had on the payroll and how many are on today?

Mr. FIELDS. I don't have the figures myself. We would have to supply it for the record.

Chairman DURHAM. You have been spending $2½ million here.

Mr. ROLLEFSON. I can tell you how many people we have on the payroll right now. What bothers me was that I thought you wanted to know in detail the members from the various universities.

Chairman DURHAM. No, I am not after that at all.

Mr. ROLLEFSON. We have 50 on the payroll now but they are not all scientists. About 25 of them are. I could write their names down and count them up. I would have to do it that way to know exactly how many were scientists.

Chairman DURHAM. Will you supply it for the record?

Mr. ROLLEFSON. We shall certainly do that.

(The information referred to follows:)

MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION,
Madison, Wis., June 4, 1958.

Congressman CHET HOLIFIELD,
House Office Building, Washington, D. C.

DEAR CONGRESSMAN HOLIFIELD: During the course of my testimony before your subcommittee on Tuesday, May 27, 1958, additional information was requested on two subjects. One was regarding numbers and source of personnel for the MURA laboratory; the other was comparative information on the cost and suitability of the Argonne and MURA sites.

The enclosed documents will, I believe, answer these questions fully. If, however, there are any questions regarding these statements or any other matters concerning MURA, please feel free to call upon me. I should also like to extend an invitation to you and for any of the other members of your committee to visit our laboratory at any time that is convenient to you.

Sincerely yours,

R. O. ROLLEFSON, *Director.*

UNIVERSITY STAFF MEMBERS ON LEAVE TO MURA

July 1, 1956, to June 30, 1957	*July 1, 1957, to June 30, 1958*
Dr. K. Symon, scientist, University of Wisconsin	Dr. K. Symon, scientist, University of Wisconsin
Dr. D. Kerst, scientist, University of Illinois [1]	Dr. R. Rollefson, scientist, University of Wisconsin [2]
Dr. P. Kruger, scientist, University of Illinois [1]	Dr. R. Haxby, scientist, Purdue
Dr. J. Snyder, scientist, University of Illinois [1]	Dr. F. Cole, scientist, State University of Iowa
Dr. R. Haxby, scientist, Purdue	Dr. G. Parzen, scientist, Notre Dame
Dr. F. Cole, scientist, Iowa	Dr. B. Waldman, scientist, Notre Dame (began June 15, 1958)
Dr. L. Jones, scientist, University of Michigan	Dr. R. Christian, scientist, Los Alamos
Dr. K. Terwilliger, scientist, University of Michigan	
Dr. L. Laslett, scientist, Iowa State University	
Dr. T. Ohkawa, scientist, University of Tokyo	
Dr. G. Parzen, scientist, Notre Dame	

PERMANENT STAFF AND UNIVERSITY OF ORIGIN

July 1, 1956 to June 30, 1957	*July 1, 1957 to June 30, 1958*
Dr. J. Enoch, scientist, University of Wisconsin	Dr. J. Enoch, scientist, University of Wisconsin [1]
Dr. J. Van Bladel, scientist, University of Wisconsin [2 3]	Dr. J. Van Bladel, scientist, University of Wisconsin [2 3]
W. Winter, engineer, University of Wisconsin	George Westlund, scientist, University of Wisconsin
E. Zographos, scientist, University of Wisconsin	W. Winter, engineer, University of Wisconsin

PERMANENT STAFF AND UNIVERSITY OF ORIGIN—Continued

July 1, 1956 to June 30, 1957

Dr. L. Fosdick, scientist, University of Illinois [1]
Dr. R. King, scientist, University of Illinois [1]
Dr. F. Mills, scientist, University of Illinois
F. Peterson, engineer, University of Illinois
Dr. A. Taub, University of Illinois [3]
Dr. A. Nordsieck, University of Illinois [3]
Dr. H. Hausman, scientist, Ohio State [3 4]
Dr. Carl Nielsen, scientist, Ohio State [3 4]
Dr. A. Sessler, scientist, Ohio State [3 4]
Dr. M. Freiser, scientist, Purdue
E. Rowe, scientist, Purdue
Dr. W. Wallenmeyer, scientist, Purdue
Dr. E. Weinberg, scientist, Purdue [3]
Dr. E. Akeley, scientist, Purdue [2 3]
Dr. T. Chang, scientist, Wayne University [3]
Dr. H. Denman, scientist, Wayne University [3]
Dr. A. Stevenson, scientist, Wayne University [3]
E. Day, engineer, University of Minnesota
Dr. H. Fulbright, scientist, University of Rochester [3]
Dr. A. Roberts, scientist, University of Rochester [3]
Dr. J. Ballam, scientist, Michigan State [3]
Dr. D. Lichtenberg, scientist, Indiana University [3]
Dr. C. Pruett, scientist, Indiana University
Dr. M. Levi, scientist, Kansas University [3]
Dr. D. Ling, scientist, Kansas University [3]
Dr. R. Stump, scientist, Kansas University [3]
M. Storm, scientist, Los Alamos
Dr. Nils Vogt-Nilsen, scientist, University of Oslo [3]
Plus:
15 graduate assistants
2 engineers
5 machinists
5 technicians
6 clerical
5 administrative
20 part-time undergraduates

July 1, 1957 to June 30, 1958

E. Zographos, scientist, University of Wisconsin
C. Davidson, scientist, University of Wisconsin [2]
C. Radmer, engineer, University of Wisconsin
M. Berndt, engineer, University of Wisconsin
W. Fry, scientist, University of Wisconsin [4]
W. Walker, scientist, University of Wisconsin [4]
Dr. F. Mills, scientist, University of Illinois
F. Peterson, scientist, University of Illinois
Dr. H. Hausman, scientist, Ohio State [3 4]
Dr. Carl Nielsen, scientist, Ohio State [3 4]
Dr. A. Sessler, scientist, Ohio State [3 4]
Dr. L. Anderson, scientist, Ohio State (began October 1957; resigned January 1958)
Dr. M. Freiser, scientist, Purdue [1]
E. Rowe, scientist, Purdue
Dr. W. Wallenmeyer, scientist, Purdue
Dr. E. Akeley, scientist, Purdue [2 3]
Dr. A. Stevenson, scientist, Wayne University [2]
E. Day, engineer, University of Minnesota
Dr. R. Bieri, scientist, University of Minnesota (began January 1, 1958)
Dr. D. Swenson, scientist, University of Minnesota (began January 1, 1958)
Dr. L. Johnston, scientist, University of Minnesota [2]
Dr. L. Jones, scientist, University of Michigan [1 3 4]
Dr. K. Terwilliger, scientist, University of Michigan [1 3 4]
Dr. L. Laslett, scientist, Iowa State [4]
Dr. C. Pruett, scientist, Indiana University
Dr. R. Stump, scientist, Kansas University (began June 15, 1958)
Dr. T. Ohkawa, scientist, University of Tokyo [1]
M. Storm, scientist, Los Alamos
Plus:
20 graduate assistants
3 engineers
6 machinists
4 technicians
5 clerical
5 administrative
22 part-time undergraduates

[1] Resigned October 1957.
[2] Part-time academic year.
[3] Summer only.
[4] Consultant.

SPECIAL REPORT ON SITE TO THE BOARD OF DIRECTORS, MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION, OCTOBER 15, 1956

By E. A. Day

SUMMARY OF REPORT OF FEASIBILITY AND COMPARATIVE COSTS FOR PROPOSED SITE FOR MURA HIGH ENERGY ACCELERATOR COMPARED BY UNITED STATES ATOMIC ENERGY COMMISSION, DATED SEPTEMBER 12, 1956

In his letter[1] to Mr. W. Kenneth Davis, Mr. J. J. Flaherty briefly discusses the comparison of the four sites as made by the Chicago Operations Office and its consultants. Mr. Flaherty points out some of the limitations of this survey particularly with respect to such things as housing and manpower, which are among many criteria which would affect the cost of building and operating a successful laboratory and accelerating machine. In the final paragraph Mr. Flaherty discusses some of the details that limit the practicality of locating the MURA accelerator on the Argonne National Laboratory site. Enclosure 2 is a table with the covering statement taken from page 2 of the United States Atomic Energy Commission report. The MURA representatives who were present at the meeting of this cost study group and those who reviewed it are in general agreement with the findings of the study with exceptions as indicated below. The availability of facilities at the Argonne site was determined from information gathered at the Argonne National Laboratory and was not investigated by the Chicago Operations Office or MURA.

The MURA representatives did and do feel that the Argonne site has definite and severe limitations because of the size and location of the bedrock structure on which the proposed accelerator would be placed. The bedrock is limestone which appears to be a good sound structure. It is of sufficient size to accommodate the accelerator as proposed on April 5, 1956, but has very definite space limitations. To the north and south there are forest preserve areas which are not a part of the Argonne site. The Argonne land between these two forest preserve areas is approximately 1,200 feet wide (the MURA accelerator with a target station at each end would be approximately 1,200 feet across). To the west of the accelerator site is a small creek with appreciable flows of water during rainy seasons. To the east of the site is a lesser drainage area which probably carries some water over the surface of the bedrock. To locate the accelerator between the two forest preserves and to place its foundation at the surface of the bedrock, it would be necessary to utilize approximately 50 feet of forest preserve land at each end of the machine during the construction period to allow for a one to one slope in excavating the topsoil.

The size of the site definitely limits the construction to the design presented to the AEC in April 1956, or to a smaller one. It would be impractical to build one-half of the proposed accelerator on this site and expect to find room one an adjacent location for the building of completely new accelerator if necessary or desirable.

In the study of cost of excavation and foundation at the Argonne site the elevation of the floor of the accelerator tunnel and the central working area was established at an elevation of 605 feet above sea level (approximately 50 feet below ground level). Four borings were made at the Argonne site. Boring No. 2 showed a water level at elevation 605, the same as the proposed bottom of the tunnel. Because of the limitation of time for surveying water conditions more thoroughly, particularly on the year-round basis, it cannot be assured that the ground water level will not rise substantially higher than the figure in boring No. 2, which was made in August of 1956. Dames & Moore, the soil mechanics engineers making this study, state, "In the event of a flood condition in the stream west of the site the ground water level would be substantially higher and might prove detrimental to the operation of the accelerator." MURA representatives feel that unless costly procedures are taken to prevent flooding of the accelerator, this high ground water would prove disastrous to the operation of the accelerator. These procedures would include complete sealing of the tunnel and foundations against water seepage; reworking the underground water channelways to provide rapid drainage away from the area; and emergency pumping of storm water from within the enclosed areas of the machine. It has been the philosophy of MURA design people that gravity drainage from the enclosed parts of the accelerator should be available to

[1] Enclosure 1.

provide for storm water outlets. This could not be the case at the Argonne site but could be at the three MURA sites. To assure removal of storm water from the accelerator at the Argonne site, standby pumping equipment would be necessary. Power for such pumping must be independent of the electric utility company whose transmission facilities are subject to damage during electrical storms which frequently accompany the most severe rainstorms. This would mean the installation of a sizable diesel, gasoline, or steam power source.

The need of placing the accelerator foundation at approximately 50 feet below the surface of the ground at the Argonne site as compared to 20 to 30 feet at the MURA sites would add complications to the material handling during the construction of the machine and to its operation. The added depth would add cost both in dollars and time required for completing the project and to subsequent experimental programs. The material handling difficulty is considered to be far less significant than the limitations on size of the area and the difficulty of ground water control at the Argonne site.

ENCLOSURE No. 1

SEPTEMBER 12, 1956.

To: W. Kenneth Davis, Director, Division of Reactor Development, Washington, D. C.

From: J. J. Flaherty, Manager, Chicago Operations Office.

Subject: Comparative analysis for sites of MURA accelerator.

Following the meeting between the Commissioners and the presidents of the universities forming the Midwest Universities Research Association in the Commission offices on May 25, 1956, the Commission undertook to investigate the possibility of locating the MURA machine at the Argonne site as compared to the three sites proposed by MURA. The Chicago Operations Office was assigned the responsibility for performing this investigation. Our report, together with the findings of consultants and staff on which it is based, is attached.

In brief, we set out to determine whether it was feasbile from the standpoint of physical site characteristics to locate the machine at each of the 4 sites (Argonne, Minnesota, Purdue, and Wisconsin) and to estimate the construction costs at each of the 4 sites of those aspects of the project which could reasonably be expected to vary from 1 site to the other. It is emphasized that this study was primarily an investigation of the engineering feasibility of locating the MURA machine as presently conceived at the several sites. It did not go into the many other factors, such as housing, availability of manpower, etc., that should be considered in a site selection survey.

The information developed indicates that it is feasible to locate the accelerator at any of the 4 proposed sites and that the variation in cost of facilities is only about $500,000 from the least costly MURA site recommendation to the Argonne site, which appears to be second from the standpoint of construction costs. As between the Argonne site and the most costly MURA site recommendation, the difference again is only about $500,000.

In a project of this size and with the great uncertainties in estimating, numbers of this magnitude do not appear to be decisive. This conclusion is strengthened when one considers that variations in operating costs over a period of years, including such items as power costs and labor rates, are likely to dwarf these differences.

Representatives of MURA, who have briefly reviewed this report, expressed general concurrence in its findings, but also have certain reservations. They feel, for instance, that the limitation of physical size of the Argonne site robs it of flexibility which can be obtained at other sites. They also point out the limited nature of the investigation and the need for examining many other factors if a definitive site survey is to be undertaken.

ENCLOSURE No. 2

Cost table with covering statement from page 2 of United States Atomic Energy Commission report entitled "Report of Feasibility and Comparative Costs of Four Proposed Sites for MURA High Energy Accelerator, September 12, 1956."

Following is a tabulation summarizing the estimated foundation, cooling water, and land costs for each of the proposed sites. In addition, the estimated cost of those facilities which vary in cost among the sites has been included to provide a total construction cost variation. (It should be noted that in some

cases the lower estimate required for certain facilities at Argonne may represent a deferral of costs rather than an actual saving in the long run.)

TABLE I

[In thousands]

	Argonne site	Minnesota site	Purdue site	Wisconsin site
Foundation	$1,660	$1,000	$1,070	$1,000
Water	925	180	1,123	321
Land	0	0	88	224
Facilities and utilities which vary in cost between sites	1,979	2,850	2,852	2,859
Total	4,564	4,030	5,133	4,604

Representative PRICE. Mr. Chairman, I think Senator Wiley put his finger on the nub of the thing in his statement when he said that the question was, when are we going to get on with the project.

In the examination of that, you stated, Dr. Rollefson, that there has not been so much delay caused. There are a lot of things that enter into the element of delay. One of those things is to arrive at a final definite proposal. Is that not true?

Would you say that the proposal from the MURA project at this time is in such shape as to make it possible to make a final decision on the project?

Mr. ROLLEFSON. I think we could make a final decision to go ahead with building this type of accelerator. We are confident it will work. We expect, however, in the detailed design work which would occupy the first year and a half to 2 years——

Representative PRICE. I understand your position is that there has been an element of delay because of the failure to authorize the third model.

Mr. ROLLEFSON. Because of the uncertainty of support, the parts for the third model were not ordered when they could have been ordered; that is correct.

Representative PRICE. In order to make a final proposal of what type of machine you are going to build, you would have to do some work with the third model?

Mr. ROLLEFSON. I think the third model will influence the detailed design of the parts perhaps.

Representative PRICE. Would you be in a position today to go ahead with the construction of the machine that you are thinking about, which was referred to at one time as the dream machine, without work on the third model?

Mr. ROLLEFSON. I would like Dr. Symon to answer that, if he would.

Mr. SYMON. You ask if we would be ready to go ahead with construction?

Representative PRICE. Engineering, design, and construction and really get started, of placing the Commission in a position to be able to make a final decision that they are going to support the construction of this machine.

Mr. SYMON. We would be ready to go ahead today with the engineering design. The construction would come in a period of about 2 years from now.

Representative PRICE. Without work on the third model or without work with the third model?

Mr. SYMON. The work on the third model is a part of the engineering design of the final machine. You may remember in the case of the accelerator being built at Brookhaven, after they were authorized to go ahead they built a model. I think they called it an analogue for the purpose of studying the behavior of accelerators of this type as a part of the design process. So we would certainly not stop building this next model.

Representative PRICE. Then you do feel that there could be a final decision to go ahead on the ultimate machine.

Mr. SYMON. Yes, I feel that there could.

Representative PRICE. How long have you been working on this third model?

Mr. SYMON. Let me see. We began preliminary designs on it I guess something over a year ago. The parts were ordered last winter in December, I think.

Representative PRICE. But definitely there has been a holdback in your ability to go ahead and work on this model as the MURA project desires to do it because of lack of decision from the Commission?

Mr. SYMON. Yes, it is true that we put off ordering the parts for this model for some months.

Representative PRICE. Is it a matter of decision now or a matter of failure to make funds available?

Mr. SYMON. I think it was because a year ago we felt that if we were to order the parts and the project were not continued, we would end up with a warehouse full of parts and nothing to do with them. So we put it off until we were sure that we would be continued beyond last fall.

Representative PRICE. This is a matter of decision, then. Is it a financial matter or a policy matter?

Mr. SYMON. My recollection is that it was a policy matter.

Representative PRICE. Is the clashing beam concept different from those incorporated in the earlier models?

Mr. SYMON. No. They both proposed clashing beams.

Representative PRICE. Do you believe that you have sufficiently proved out the clashing beam concept to justify immediate drafting of preliminary design for the full-scale machine?

Mr. SYMON. Yes, we do.

Representative PRICE. You say you have proved that out. I thought that was the purpose of the third model.

Mr. SYMON. I should say that I would not——

Representative PRICE. You need additional work?

Mr. SYMON. I think it would depend on whom you asked. I think some of us feel that the work we have done on the models already since the basic principles are established is sufficient.

Representative PRICE. You would get additional knowledge from the third machine?

Mr. SYMON. Additional, and additional assurance.

Representative PRICE. But the concept has been proven to the point in the first two machines that you feel justified in going ahead with the design and engineering?

Mr. ROLLEFSON. I think one way of looking at it is that the first two models have demonstrated the validity of the principles. The third model will actually do the job, but with electrons on a small scale.

Representative PRICE. The third model is for the purpose of additional assurance. Even without the third model, you have assurance from among those who are working on the models to the extent that they are confident that it is time to go ahead with the design on the ultimate machine?

Mr. SYMON. That is correct.

Representative PRICE. Is that about right?

Mr. SYMON. Yes, sir.

Representative PRICE. How long will it take to do preliminary design work before actual construction is started?

I am thinking now of the final machine.

Mr. ROLLEFSON. The actual construction of the part of the machine that is built out of iron and copper probably wouldn't start for two years from authorization. But preparation of site and construction of some of the buildings ought to start immediately if one is going to be ready to start on the machine in a couple of years.

Representative PRICE. The 8-year figure that you used in your statement, does that mean that if you get started within 2 years on construction, it would be 8 years from the day you would have the machine?

Mr. ROLLEFSON. It would be 2 years before one could order the iron. Our optimistic estimate indicated that inside of 3 years of the time the iron was ordered, we would be getting the actual accelerator assembled. There is an awful lot of material to be obtained and it cannot be obtained in a hurry.

Representative PRICE. You mentioned the figure of about 8 years before you get this machine in operation. What is the basis of that figure and what would be your starting date?

Mr. ROLLEFSON. I think the 8 years is just a less optimistic estimate and probably allows for a little of the work that we have already done. This estimate of 8 years was made about a year ago. It is very difficult to pin down the time that it is going to take.

Representative PRICE. If you were going all out on the project now and you had the go-ahead signal on the machine, how long would it be before you would be in operation?

Mr. ROLLEFSON. I think it could not be assembled until 1963 and one would probably have to spend a good fraction of a year, if not a year, getting everything lined up and getting the machine into operation, and then maybe by late 1964 or 1965 before you could say it was really in operation.

Representative PRICE. It would take you about a year to get the bugs out of it and into operation after it was complete?

Mr. ROLLEFSON. We hope it will run when we turn it on, but it never seems to happen.

Representative PRICE. It is normal that they do not usually run at the start. There are adjustments to make and there are many months before it really works.

Mr. ROLLEFSON. Even though it works right away, you could probably get it to work much better by altering it slightly.

Representative PRICE. How much money has the AEC so far contributed to the MURA project?

Mr. ROLLEFSON. I believe it is about 2½ million.

Representative PRICE. How much have the universities contributed?

Mr. ROLLEFSON. The universities contributed in that they supported the technical group during the first three-quarters of a year back in 1953 and early in 1954 before we had any outside help. Then they each contributed $10,000 to become members of MURA. Since that time, the National Science Foundation, the Office of Naval Research, and the Atomic Energy Commission have supplied the money that has been needed by the technical group.

Representative PRICE. The National Science Foundation has contributed to the project?

Mr. ROLLEFSON. Yes. The National Science Foundation gave us our initial support back in early 1954 and supported us up until the spring of 1956 when the Atomic Energy Commission took over the support.

Representative PRICE. Do you recall how much the National Science Foundation has contributed?

Mr. ROLLEFSON. I don't recall the total amount. It is approximately one-half million dollars total.

Representative PRICE. Will they continue to participate in the project?

Mr. ROLLEFSON. I should add that just at the present time we are being supported by the National Science Foundation to the extent of $160,000 to pay the rent on our computer. We did not have enough this year to keep the computer running, and they came to our rescue.

Representative PRICE. You said also that the Navy has contributed?

Mr. ROLLEFSON. Yes. During the period that we were supported primarily by the National Science Foundation, the Office of Naval Research contributed a considerable amount. I believe it was in connection with starting the models. I don't remember the exact amount that they contributed. We could look that up for you.

Representative PRICE. There is a pretty general recognition of the importance of this project in basic research?

Mr. ROLLEFSON. I didn't understand that.

Representative PRICE. There is a general recognition of the importance of the project?

Mr. ROLLEFSON. Yes, sir.

Chairman DURHAM. Would a computer be involved in the $80 million?

Mr. ROLLEFSON. Yes. We would need to keep the computer throughout the construction period.

Chairman DURHAM. You are just renting one at the present time?

Mr. ROLLEFSON. We probably would continue to rent. It might turn out to be advisable to either build one or buy one. But the computer art is changing rather rapidly and under those circumstances, it may be advisable to continue to rent so that we can keep up to date in our computer facilities.

Chairman DURHAM. Doctor, I did not ask you this, but I think you should state it for the record: I understand you are speaking for the entire group of universities this morning.

Mr. ROLLEFSON. Yes, this is my impression. I am speaking for the MURA Laboratory certainly.

Chairman DURHAM. That is what I meant.

Mr. ROLLEFSON. Yes, sir.

Representative PRICE. Doctor, I would like to ask this question since it has come up in some of the questioning, and particularly when you think of the university versus a Government laboratory site. Is there any feeling on the part of the scientists in the work within a Federal laboratory, and particularly a project of this sort, that they are in any way restricted or hemmed in?

Mr. ROLLEFSON. This is a very difficult question for me to answer.

Representative PRICE. I am not talking about the scientists who are in the employ of the Commission. I mean a group of scientists who would participate in projects such as this if it were located on a Federal laboratory site.

Mr. ROLLEFSON. I have myself worked at Federal laboratories and I don't feel any.

Representative PRICE. In your statement on page 5, you say that, however, there does not appear to be any practical way of building the accelerator at the Argonne other than for MURA to give the operation of the project and for the Argonne to organize a group to carry on the work.

It has been my understanding—and I certainly do not want to get involved in the argument over the location of the accelerator, those are things you are going to have to work out, and I can understand the university position and I can also see some merit to the Commission position—my understanding was that Argonne would take MURA in as a separate division to operate the project, even if it were located at the national laboratory.

Mr. ROLLEFSON. I think the understanding was that the MURA technical people, at least many of them, would be welcomed as employees at the Argonne and an accelerator division could be created in which they could work. We feel that is different from having the project assigned to MURA.

Representative PRICE. What would be the difference?

I am trying to develop whether the scientists feel that they would be restricted in any way.

Mr. ROLLEFSON. The universities would not feel any responsibility. I should not say "any," they would not feel as much responsibility as if the job was given directly to the Association of Universities. They certainly would not have the authority that they have in MURA. The people would be going to the Argonne as Argonne employees. They might still be on leave from universities, to be sure. But their universities would have no particular authority over the program.

Representative PRICE. Even if the project were operated on the Argonne site by MURA itself?

Mr. ROLLEFSON. I think that is not practical.

Representative PRICE. It is my understanding that was the sort of provision that might be attempted to be worked out.

Mr. ROLLEFSON. No, I don't believe so. I think the MURA organization was to have no direct authority. Some of its members could be on the advisory board, but the MURA organization would have really no reason for existence if it didn't have authority and responsibility.

Representative PRICE. You do not think it would be practical to locate the machine at Argonne and have the project operated as it is today by MURA?

Mr. ROLLEFSON. I think that is correct. It is not practical. You would have two managements in the same site and I don't believe anybody thinks this is advisable.

Dr. Crane would like to comment.

Senator BRICKER. Doctor, if you proceed with this program as you anticipate and the Commission authorizes it and we appropriate the money, would you be able to contribute something basic since that could not or is not being duplicated anywhere else in any of the laboratories?

Mr. ROLLEFSON. Yes, we certainly could.

The colliding beam scheme will give energies equivalent to the energy that would be obtained with a conventional machine of 540 billion volts capability. The largest that is even contemplated or the largest that has been authorized is 30 billion at Brookhaven. This is a very large step from 30 billion.

There is another respect in which it will be considerably higher in capability than anything under construction now and that is in the strength of the current of particles. There will be many more particles per second available from this machine than from any now under construction.

Senator BRICKER. There is no distinction in the original setup which you are seeking from that which the Commission has at Brookhaven?

Mr. ROLLEFSON. I think it is modeled very closely after the organization at Brookhaven.

Senator BRICKER. That was my impression.

Mr. ROLLEFSON. We used Brookhaven as a model actually and got their literature.

Senator BRICKER. In your original setup?

Mr. ROLLEFSON. Yes.

Representative PRICE. I think, Dr. Crane, you were going to comment on my last question.

Mr. CRANE. I was going to say that we have searched very hard for some possible organizational scheme which would allow the machine to be built at Argonne under partial MURA management or at Madison under some partial management of the AEC; in other words, some combination scheme which you, I believe, were trying to ask us to discuss. At two different times we had a meeting at the University of Chicago at which there were members of the Argonne Laboratory, representatives of the University of Chicago which is the contractor for the Argonne Laboratory, and MURA representatives.

The purpose of these two meetings was to sit down and search for some organizational scheme by which the two organizations could get together and satisfy the desires of the AEC and of MURA at the same time. We discussed four possible schemes.

One was to have the machine at the Argonne and operated in some way by MURA. The other was to have it at Madison and under some kind of operation by the AEC. The other two possibilities were of having it at the Argonne under Argonne management, and of having it at Madison under entirely MURA management.

The two middle possibilities were the ones we discussed principally; that is, of having it at Argonne with some MURA management, or at Madison under some degree of AEC management.

We searched very earnestly and everyone at the meeting was very sincerely desirous of finding some possible scheme. We came away from both of these meetings without any solution which we thought would work.

I must say there was no bickering. It was a very earnest search on the part of all parties concerned. That has been explored very thoroughly.

Representative PRICE. Thank you very much.

Senator BRICKER. I am concerned this morning about there only being representatives from the University of Wisconsin here. Why are there not other universities represented at this hearing? Is it a matter of site that we are interested in, or is it a matter of proceeding with the whole program?

Mr. CRANE. I am from the University of Michigan.

Senator BRICKER. Then there are two.

Have the other representatives of the universities in MURA been alerted to this meeting this morning, or were they consulted in regard to it, or do you speak for all of them?

Mr. CRANE. Some of them have. We were called on short notice and invited here by Senator Wiley. I communicated with 2 other members of the MURA board, Father Hessburg, president of Notre Dame University, and president Hovde of Purdue, and tried to get 1 of them to come here with us, but neither of them was able to come. So we did try to get some other representatives.

Senator BRICKER. In other words, there is a representative from each of the universities on this board, is there not?

Mr. CRANE. Yes, there is.

Chairman DURHAM. I understand that the doctor was speaking for the whole group of universities.

Senator BRICKER. That was the purport of my question.

Mr. CRANE. There are 15 universities and there are 20 board members.

Representative HOLIFIELD. The position you are giving to the committee this morning is a position taken by the full board?

Mr. CRANE. Yes.

Representative HOLIFIELD. This is representative of previous resolutions and conferences of the full board. So you are not doing this independently? You are doing it as representatives?

Mr. CRANE. Yes. What we say is representative of the board opinion.

Representative PRICE. Mr. Chairman, I would like to commend and compliment the MURA group as a whole on the gentlemen representing them today, because I think they are doing a tremendous job in a very important field and certainly are entitled to support of all of us, the committee and the Commission. I am certain the committee and the Commission want to accord full support.

Th matter before us today is one of judgment and I think will be resolved, I hope happily, because it is a very important project in the interest of basic research. It is one that should not only have the support of the congressional committee and the Commission, but the country as a whole. I think this is one area where we ought to be giving the greatest attention at this time.

Representative HOLIFIELD. Will you proceed and finish your statement at this time?

Mr. ROLLEFSON. Yes, I would like to continue with reasons why we think it is important to be in the neighborhood of a university.

We also believe that basic research should not be divorced from the educational process. A high energy facility operated as a university laboratory could be made available to university faculty and advanced graduate students and would serve a very important educational as well as a research function.

In view of some unfortunate publicity which has appeared, we want to make clear that we are not criticizing the Argonne Laboratory. We believe that it is performing its useful functions very well indeed.

We should like to point out that since the earliest days of MURA, Argonne scientists have made valuable contributions to our technical discussions, and we have always had friendly cooperation from Director Hilberry and his staff.

However, much as we believe in the Argonne, we are strongly opposed to the idea that all expensive scientific activity in a particular field must be concentrated in one installation. The failure of the German atomic bomb program during the war can be ascribed directly to the fact that they had a single man in control of the whole program and although he was probably the best man for the job, the course he chose happened to be the wrong one.

Senator BRICKER. That is the reason we are here today.

Mr. ROLLEFSON. Yes.

Senator BRICKER. We would not be here otherwise.

Mr. ROLLEFSON. I do not think one can conclude that one always reaches such fortunate conclusions.

Mr. CRANE. He means we would have been dead.

Mr. ROLLEFSON. Yes, I know.

It is important to consider very carefully whether the possible economies and other alleged advantages to be gained from locating all interuniversity research at 1 location under 1 management are really sufficient, in comparison with the disadvantage and risks involved, to justify setting up a monolithic research institution to control all such activities in the Midwest.

Whatever may be the case with regard to development and production activities, we believe that basic research proceeds most rapidly and successful when it is carried on by as many competent and independent research groups as can economically be supported.

In conclusion, we would like to express the hope that when the responsible authorities are convinced of the feasibility of the proposal we have submitted, it will be possible for us to get assurance that the Government intends that we should carry the project through to completion.

Scientists who work on a project such as this are staking a great many years of their productive lives on the ultimate success of the project. They have sufficient confidence in the technical feasibility of the program to be willing to do this, but it is unreasonable to ask them to continue indefinitely with no assurance that they will ever be able to carry the work to completion.

What is needed is an early decision on site and an authorization which will allow us to proceed with each phase of the project in an orderly fashion, to complete the detailed accelerator design, to carry out foundation studies on the chosen site, to begin construction of buildings so that they will be completed when needed. Actual ex-

penditure of large sums of money on major component of the accelerator need not come for another 2 years, during which time further studies and improvements will be made which will afford even greater assurance of the success of the project.

Chairman DURHAM. Doctor, these tools are very expensive, as we all realize. Taking into consideration that matter, do you feel that such a project as this could be carried on without Government support?

Mr. ROLLEFSON. I think it is extremely unlikely. I can say that we have looked for other sources of support and none of them seem very promising.

It seems to me that this is an ideal example of the kind of thing that should be done on the Federal basis. It is much too big for each State or each university to do it on its own.

Chairman DURHAM. We have adopted such a policy already in the national laboratories?

Mr. ROLLEFSON. Yes.

Chairman DURHAM. I do not think it is any different from yours. I like your approach to it, to be frank, because I happen to live in a university town myself. I think the atmosphere is so different on a college campus from a national laboratory that I like the idea of a university campus. I think you have a different atmosphere. You have a different approach. You feel freeer to express your own opinions than you do when somebody is standing around. That is just natural. I think you get better results, too.

Mr. ROLLEFSON. We certainly agree with you.

Representative PRICE. To tie it down, what is the actual need of today to go on with this project? Has MURA submitted a concrete proposal for authorization for a specific thing for this year that would prevent further delay in the program?

Mr. ROLLEFSON. Yes; we have a proposal. It is one that I mentioned that is under technical review right now.

Representative PRICE. Which one is that?

Let us tie that one down.

Mr. Holifield heads up an authorization committee, so we would like to know what might be considered as a line item in an authorization bill that would be considered by the committee.

Mr. ROLLEFSON. We have been encouraged to believe that we will have support for the technical developments that we have listed in this proposal for the next year, but that there will be no money for site development or buildings.

Representative PRICE. What would you need for the technical support this year?

Mr. ROLLEFSON. 1.4 million.

Representative PRICE. And that would be operating funds, is that right?

Mr. ROLLEFSON. That is correct.

Representative PRICE. What else would you need in the way of authorization to get this thing moving?

Mr. ROLLEFSON. About 1.4 million more is what we estimated for the site development and construction of one building which would be ready as soon as possible.

Representative PRICE. That would be for a laboratory building?

Mr. ROLLEFSON. Yes.

Representative PRICE. That is 1.4 million for construction?

Mr. ROLLEFSON. Yes, sir.

Representative PRICE. Is there anything else that you would need in the way of an authorization?

Mr. ROLLEFSON. We would like as soon as possible to get some assurance that we are to build an accelerator because we are always in difficulty with people feeling that they are endangering their careers too much to stay on a program like this unless it has a future. We are losing one of our key people who has resigned as of July 1. I am essentially sure he could be retained if we knew we were going ahead.

Representative PRICE. Is there unanimity among all the scientists in the MURA project as to your possibility of your going forward now from the technical viewpoint?

Mr. ROLLEFSON. I believe that there is, yes. There may be minor differences that will be ironed out during the design period, but there is unanimity that we can go ahead with the type of accelerator proposed in our revised proposal.

Representative PRICE. Dr. Symon, would you like to comment on that?

Mr. SYMON. I would simply like to agree with what Dr. Rollefson said.

Senator BRICKER. With that position, up to the present time you have not been able to get the assurance from the Commission?

Mr. ROLLEFSON. We have recently, as I mentioned, been encouraged to believe that we will have the 1.4, but not anything else.

Senator BRICKER. There has been no definite assurance given yet as to the construction of the laboratory and the proceeding of the building of the machine?

Mr. ROLLEFSON. That is correct.

Senator BRICKER. That is the next step?

Mr. ROLLEFSON. Yes.

Senator BRICKER. That is essential in your program?

Mr. ROLLEFSON. That is right.

Senator BRICKER. The next would be the authorization by the Congress of the expenditure for that purpose?

Mr. ROLLEFSON. I presume so. I am not sure what order these things have to take.

Senator BRICKER. And then the appropriation of money comes after?

Representative PRICE. Of course, the 1.4 for the laboratory would indicate that a decision had been made where you are going to locate the machine?

Mr. ROLLEFSON. It would mean that we intended to build some machine anyway. The exact nature of the machine could still be changed. But that certainly would be a commitment.

Chairman DURHAM. Do you think that the whole group in MURA would feel the same as you do if we appropriate the 1.4 million for the laboratory site?

Mr. ROLLEFSON. I certainly think they would. It would be a tremendous boost to the morale of the group.

Chairman DURHAM. I realize the difficulty, because basic research does not come overnight. It is something that a man spends his lifetime on, or 15 or 20 years. I can understand readily why there is

confusion in the minds of the scientists in taking on a project which may not have a future.

Representative HOLIFIELD. Doctor, the normal way for the committee to proceed would be to authorize this full amount, $85 million or $100 million, whatever the estimate was that would come before us, and then each year the AEC would go to the Appropriations Committee and ask for the appropriation they need for that respective year against this authorization.

In putting out an authorization bill, we have between $300 million and $400 million already planned for this particular one. This would mean adding another hundred million dollars to the authorization bill. We have some other projects, too, that are very urgent, particularly in the plutonium field and the producing of plutonium, which is generally considered to be one of our most urgent projects because it is for weapon production.

Of course, the Budget Bureau and the AEC, when they look at all of these different demands, cannot put them all in. They have to select some and put them in and leave some out. I do not know what their conferences were with the Budget Bureau, but I do know of other items even in the weapon field that were knocked out by the Budget Bureau because of the budget situation.

We are faced with a very wide demand and it has to be balanced to a certain extent against the available funds which the Bureau of the Budget thinks should be authorized and which Congress would support.

This committee has always been very strong for basic research. I think you made a very powerful presentation this morning.

Senator BRICKER. May I ask General Fields one question, Mr. Chairman?

Representative HOLIFIELD. Yes.

Senator BRICKER. Generally, do you feel that in the basic research program that there is much to be contributed by this particular project, regardless of whether it is operated by MURA, by Argonne, or by them jointly, or wherever it might be located?

Mr. FIELDS. Senator, as I understand the scientific opinion, if this machine would do what is forecast, it would certainly be a major contribution.

Senator BRICKER. And we will never know until we try it?

Mr. FIELDS. That is true. There are questions of feasibility and cost that come into that determination whether this country can go ahead with this and with the large Stanford machine, too.

Senator BRICKER. Do you feel that the operation of a project of this sort by MURA would break into the scientific field many new people that might not otherwise have come into the field?

Mr. FIELDS. I believe it would, Senator Bricker.

The vexatious problem in a way is to provide in the Middle West something that will pull together the very outstanding talents that exist there so that they can go forward in this research.

Senator BRICKER. It would be very valuable as a student training focus, would it not?

Mr. FIELDS. I presume it would have some incidental benefit of that nature. But its primary purpose would be to move forward and to continue to move in the exploration of the nucleus and to the new things that no one can really specify now that might be discovered.

Senator BRICKER. The same thing is true of the machine they are talking about?

Mr. FIELDS. Senator, I thing under either organization, and it would be the hope of the Commission whether it is a direct MURA operation or whether some way this can be integrated with the Argonne operation, that this could move forward. I would hope that it could. This has been unfortunately a discussion that has been going on for several years. I do not believe it has been brought out here that there is participation by all these universities in the Argonne already in the other activities. We have had a council of participating institutions that is an advisory body to the contractor there at Argonne. The thought has been, how could this all be integrated so they could all participate not only in the reactor, educational, and research fields, but particularly in the high-energy physics field.

When you look forward 5 and 10 years, you have to look where it is all going when you settle on just how you do have this go forward. There is every intent to support this. We do have provision in the forthcoming budget for this support we are talking about.

Senator BRICKER. That is the $1.4 million?

Mr. FIELDS. That is $1.4 million for the continuation of what they have been doing. There is the question of facilities and the authorization and what time that is appropriate to be sent to Congress.

Senator BRICKER. I happen to have some contact with western conference schools, and I think I am in a position to know, I think I can say this advisedly, Doctor, that there is great interest in this. I think there could be a tremendous contribution to the whole scientific field and that there is more interest in MURA than there is in Argonne. There is a closer intimate connection between the various universities with a project of this kind than there would be in Argonne. That is my feeling after talking to many people who are interested in the project.

Representative HOLIFIELD. Is it your opinion, Doctor, that there is an area to be explored in this high-energy field that cannot be explored now with the existing cyclotrons and bevatrons we have?

Mr. ROLLEFSON. Yes, and even more than that. The conventional design of the accelerator can hardly be expected to reach the range of energies that should be reached by the colliding beam type that we are proposing. The cost goes up about as the cube of the energy for a conventional design machine. To go from 30 to 500 would mean a tremendous increase in cost if one tried to do it in a conventional way.

Representative HOLIFIELD. How does the size of that machine compare with the Soviet machine, according to their reports as to its size?

Mr. ROLLEFSON. Their largest one has energies available of 10 billion electron volts, and we should have 540 billion.

Representative HOLIFIELD. You should have how much?

Mr. ROLLEFSON. 540 billion. The Russians are talking about a 50 billion volt conventional type, but we have not heard any reports that would indicate they have started on that.

Representative HOLIFIELD. Our strongest machine in this field now is the bevatron at Berkeley?

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Representative HOLIFIELD. Our strongest machine in this field now is the bevatron at Berkeley?

Mr. ROLLEFSON. Yes, that is 6.2.

Representative HOLIFIELD. What is the one at Brookhaven?

Mr. ROLLEFSON. Three. The one that is under construction at Brookhaven is 25 to 30.

Representative HOLIFIELD. Which would be about the same as this, or did you say this would go to 540 billion?

Mr. ROLLEFSON. Yes, that is equivalent.

Representative HOLIFIELD. Is that because of this colliding-beam principle?

Mr. ROLLEFSON. Exactly.

Representative HOLIFIELD. That is a tremendous increase by quite a factor there. It is a factor of more than 20?

Mr. ROLLEFSON. Yes.

Representative HOLIFIELD. You think you are ready to go ahead without waiting to prove this with your third model?

Mr. ROLLEFSON. We are confident that the principles that have been checked with the two models will work. We also are a little bit alarmed by how much steel is required. In 2 years no possibility has developed that would enable us to reach these energies with less.

Representative HOLIFIELD. Why do you say you are alarmed about the amount of steel?

Our steel plants are working at half capacity right now. You did not mean the availability of steel, did you?

Mr. ROLLEFSON. I tried this argument once and was batted down. I really think we should not be alarmed by the need for steel.

Representative HOLIFIELD. Fifty thousand tons is a lot of steel. We have over 100 million ton capacity in the United States.

Mr. ROLLEFSON. Yes.

Representative HOLIFIELD. This is very special steel, I suppose. It is not the ordinary run-of-the-plant type of steel?

Mr. ROLLEFSON. That is true. It has to be rather pure iron with very small amounts of other constituents. It is not especially expensive.

Representative HOLIFIELD. I think you have made a strong statement. I was impressed by your statement in regard to the difference between the foundation factors at the sites that you propose and the one at the Argonne. I wonder if you could furnish the committee some backup material on that from your site people?

Mr. ROLLEFSON. Yes.

(The information referred to appears on p. 176.)

Representative HOLIFIELD. From what you have given us, if this factor exists and if the cost of excavating down to the sound stone at Argonne is an appreciable factor, or if there is any element involved of speculation in the action of that foundation, it would seem to me that it would be almost conclusive that it should not be at the Argonne regardless of where else it should be. It should not be there if the ground is of such a nature that you might get this variance of over a one hundredth of an inch. It would be disastrous to spend $100 million and then find out, because of your foundation, you would be in error.

Mr. ROLLEFSON. The information available up to now is not sufficient to make a definite conclusion on that point. The report that I was quoting indicated that for a somewhat smaller machine that we were contemplating a couple of years ago, the cost of building a foundation at the Argonne would be greater than at Madison.

Representative HOLIFIELD. You are going to have this review by 50 scientists, or, that is, the Atomic Energy Commission is going to ask for it. That will be completed sometime in June. We are pretty close to June.

I wonder if I could ask Dr. Williams, if he is present, Director of the AEC Research Division, what the present status is of the technical review, or are you yet ready to bring that out in public?

Mr. WILLIAMS. Mr. Holifield, the returns are coming in, you might say. I would estimate that we have roughly one-third of the returns in. We want these reviewers to take a careful look at this because, as you know, it is a very expensive thing. I would be hopeful that in the next week or two we would have the great majority in and be in a position to draw conclusions.

Representative HOLIFIELD. The latter half of June is getting pretty close to the end of the session of Congress, we hope. I wonder if you could not spur that up so the committee could have access to that report a little earlier.

Mr. WILLIAMS. We will do everything we can.

Representative HOLIFIELD. Will you send out a letter to some of your reviewers and ask them to get it in by the 15th of June?

Mr. WILLIAMS. I will try that.

Representative HOLIFIELD. Are there any further questions?

Senator DWORSHAK. Yes. I would like to ask General Fields a question. I regret I was not present when you testified earlier in the day. I should like to know whether the AEC Commissioners have considered the relative priority of this proposed project in relationship to the other vital research projects which have been under consideration.

I should like to know to what extent this does receive priority, if any?

Mr. FIELDS. Senator Dworshak, it would have to be considered in conjunction with any much larger machines than presently under construction. We have in our hands now a proposal on an accelerator at Stanford which would cost of the same order as this one, apparently. We have not arived at any conclusions as to priority between these two or whether they should both go forward at this time.

Senator DWORSHAK. Would this project duplicate any other activity?

Mr. FIELDS. I don't think it would duplicate any other under consideration; no, sir.

Senator DWORSHAK. The reason I ask this question, Mr. Chairman, is the fact that our subcommittee and the full committee are faced with a responsibility of determining where the dollar should be spent first. They say we are short of plutonium, there is a need of accelerating this project or initiating another one.

As a member of the committee, I should like to know to what extent priority should be given to these projects. I think that is very important because we can't accomplish everything at the same time. As a layman, I do not know which project is the most important.

Representative HOLIFIELD. I expressed that same thought just a minute ago. I do not know whether you were here or not, Senator, but I explained to this group of scientists that we were faced with a lot of projects and particularly this urgent project in the plutonium, which was not allowed by the Budget Bureau.

Are there any additional remarks that you gentlemen would like to make?

Senator WILEY. Mr. Chairman, I would like to have Dr. Crane and also I would like to have Dr. Symon, the technical director, open themselves to questions, but I see the noon hour is here and I am wondering when you are going to adjourn.

Representative HOLIFIELD. We are going to adjourn right away because we have a bill on the floor that has to be voted on at the House. However, I think most of the questions have been asked. If there is any question at this time of Dr. Symon or Dr. Crane, we would be glad to have them asked at this time.

Senator WILEY. Dr. Crane is from the University of Michigan and perhaps he might have a brief statement he could give.

Representative HOLIFIELD. Would you like to make a statement, sir?

Mr. CRANE. I would like to make a brief remark just to point up the two things that I think are at stake in this business. One is that we have an unusual degree of enthusiastic cooperation between the universities of the Midwest and the MURA organizations.

There are 15 universities who belong to MURA and over a number of years, and I must say through some gloomy periods, the enthusiasm and the spirit has stayed very high. The universities have been willing to contribute their scientists and the time of their presidents and officials in trying to keep this thing alive and make it go.

I think that this is something that is so unusual that it would be extremely bad if it were not supported in some way so as to take advantage of this great enthusiasm. I think if the project can come to fruition that the stimulation that it will give the universities in their scientific program will pay off in a very large way in producing more interest in science among the students. It will provide contact to the students with a very large and stimulating project so that the whole level of scientific interest in the Middle West will go up by a very marked amount if this thing can be brought into being.

Chairman DURHAM. Doctor, just why did the group of people who are connected with the universities select this project as a prime project?

Did they feel this might be of more value to the country?

Mr. CRANE. Because this field of investigation is the one which is most exciting to physicists and it stands on the very forefront of knowledge.

Chairman DURHAM. And AEC did request you to explore this field; is that correct?

Mr. CRANE. I might say one reason why they selected this field is because it is on the forefront of knowledge. The other reason is that this is the one kind of project that universities have to band together in order to do. They cannot do it by themselves because it is too big a project.

Chairman DURHAM. Because of lack of funds and one individual university having enough scientists to carry out such a project?

Mr. CRANE. Yes. It is too big a project for any one university. This is the logical kind of project for universities to band together to do.

I think those two reasons may answer your question as to why this particular field of investigation was selected.

Chairman DURHAM. It is a very fascinating field, of course.

Mr. CRANE. I would like to say that the other reason that I would hope very much that this could go through is that the development made by this group of scientists represents a major breakthrough in the art of high-energy accelerators. The jump from 25 to 30 billion volts to 540-billion-volt equivalent with higher current represents not just the next step in a long line of small steps, but it is a major breakthrough.

So I think for that reason I hope very much that when the considerations of the 50 scientists have been received and we all have the benefit of their advice and comments, that some way can be found to get this on the road. I do not know what the exact arrangement will have to be between the AEC and MURA, but I hope very much that the thing can be gotten on the road and rapidly. I think it is something that is very much worth doing.

Chairman DURHAM. Thank you very much, gentlemen, for your statement and thank you, Senator Wiley, for being before us.

Senator WILEY. Might we have a brief statement from Mr. Symon? He is the technical director.

Mr. SYMON. I think I would just like to indicate my support of the statement which Dr. Rollefson has read as the joint statement from the two of us. I am particularly happy to be able to record here my opinions and feelings on the matter of the location of this project.

Representative HOLIFIELD. Thank you. It was a pleasure to have you at our research hearings last year and have you here again.

General Fields, will you please make available to the committee as soon as possible the review by the scientists on this project?

Mr. FIELDS. Yes, sir.

(The information referred to follows:)

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., June 25, 1956.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: During the May 27, 1958, hearings of your committee it was requested that the summary of the technical reviews of the second Midwestern Universities Research Association (MURA) proposal for a high energy facility be made available to you.

I am enclosing a copy of this document. If the AEC can give any other assistance on this matter, please feel free to call us.

Sincerely yours,

H. S. VANCE
(For the Chairman).

Enclosure: Summary of technical reviews, MURA proposal.

SUMMARY OF OUTSIDE TECHNICAL REVIEW OF THE SECOND MURA PROPOSAL

The MURA revised proposal for a high energy facility dated March 14, 1958, was sent by the Division of Research to 59 scientists for review. Of these, 20 could be characterized as "designers and builders of large accelerators"; 16 were experimental physicists and 12 were theoretical physicists with extensive experience in high energy physics, while 11 would fall in the category of "elder statesmen" (i. e., laboratory directors, etc.).

Fifty-one replies were received by June 11, 1958. In discussing the detail of these replies, specific points will be illustrated by direct quotations from the letters. Before discussing the numerical analysis of the replies, it should be

pointed out that numbers can be misleading. Frequently, certain points are not discussed by all reviewers, and often the reply of a reviewer has to be weighed against the man's knowledge and experience in the field which is being discussed. It should also be pointed out that occasionally local design prejudices color the evaluation.

As can be seen from the attached copy of the letter sent to the scientists requesting the review, comments on four distinct areas were requested. Specific replies to these will be summarized first.

FEASIBILITY OF THE PROPOSED ACCELERATOR

Thirty-seven reviewers commented on the question of whether feasibility of the proposed accelerator had been established as of now. Twelve felt unequivocally that feasibility had been established, while 13 believed that feasibility of the accelerator was doubtful. Four reviewers believed that the single ring, 15 Bev. high intensity machine would be feasible while the clashing beam, 2-way accelerator feasibility was still in doubt. Finally, 5 reviewers declared that while there were still many unproved aspects of the accelerator, they had sufficient faith in the technical ability of the MURA group to believe that these difficulties would be surmounted. Of the accelerator builders and designers, 5 felt that feasibility had been established, 7 questioned feasibility of the device at this time, 3 believed the single beam machine feasible while feasibility of the clashing beam accelerator was still doubtful, and 2 stated belief in the feasibility based mainly on their faith that the MURA group could surmount the still unsolved problems.

Construction feasibility

	Established		Questionable		
	Operation for both single-beam and clashing-beam purposes	Single-beam operation	Operation for both single-beam and clashing-beam purposes	Colliding-beam operation	Questionable, but can be overcome by MURA staff
Accelerator builders	5	3	7	3	2
High-energy experimentalists	2		1		
High-energy theorists	3	1	2	1	1
Elder statesmen	2		3		2
Total	12	4	13	4	5

The following quotations demonstrate the various points of view:

Established feasibility of the accelerator.—"There is now enough technical knowledge accumulated to begin, with considerable confidence, the design of the FFAG described in the proposal. A few remaining questions concerning properties of orbits, space charge, and beam stacking will surely be understood after experiments are performed on the 50 Mev. model. (This model is very important for advancing the techniques of accelerators, and allied devices as well, and should be strongly supported.) There is no need to comment now on numerous details of design, since these will be worked out during the period of study and modeling that must precede construction. I do not believe that any serious doubt remains concerning the feasibility of constructing and operating the proposed accelerator."

"The 15-Bev. two-beam accelerator proposed by MURA appears to me to be feasible and useful, and worthy of support. I believe that an accelerator of the type proposed is the best bet for the next step in the very high energy physics after the Brookhaven AGS and other machines now on the way. However, many difficult problems remain to be solved as is recognized by the MURA group."

Questionable feasibility.—"To sum up, I would say that the general principles employed for this accelerator are all valid. But the design itself is pushing things too far in almost all directions."

"I think that the technical feasibility of constructing and successfully operating a full-scale accelerator of the proposed type at the present time is very doubtful. One area in which further developmental work is necessary is high vac-

uum technology. While I think it is probable that a large system can be designed to work at a base pressure as low as 10^{-9} mm., I am concerned that the conditions imposed on materials, design and operation procedures may be so severe as to impair the utility of the machine. Since this very high vacuum is essential to the proper functioning of the accelerator, I believe that the technology should be demonstrated on a moderately large scale before a commitment is made on the full-scale accelerator. In addition, I believe that the space charge and plasma effects and beam-beam interactions represent uncertainties which are difficult to remove by any means short of actual operation of a prototype accelerator. I believe that a model or series of models should be built which will demonstrate all of the essential features of the full-scale accelerator, including the establishment of clashing beams and the detection of interactions. It would be best if this were a proton model, and it might be possible to make it an accelerator which would have subsequent use as a research device; for example, it might be a high intensity accelerator at about 1 Bev. energy. However, in a project of this magnitude I believe that the modeling is so important that it alone justifies the cost, and the test functions should not be subordinated to building a useful accelerator."

In connection with the technical feasibility discussions, special questions were raised by many reviewers about the extreme vacuum requirements. Thus, 11 questioned the feasibility of the vacuum required for colliding beams. The proposal was sent to two high vacuum experts. One of these stated that he believed the required vacuum was feasible with present day techniques, while the other indicated some doubt as to the vacuum feasibility with present methods.

	Vacuum problems	
	Difficult to overcome	Can be overcome
Accelerator builders	7	1
High energy experimentalists	2	
Elder statesmen	3	
Total [1]	12	1

[1] The difference between the total shown here and the replies received represents the number of reviewers who did not comment on this particular question.

In connection with the feasibility discussions, 13 replies recommended further interim model studies. Of these, 6 suggested that feasibility could be better evaluated after the results of the 40 Mev. clashing beam electron model, which is now under construction, had been evaluated. Half of the replies dealing with this point were from the accelerator builders.

VALUE OF THE PROPOSED ACCELERATOR AS A RESEARCH TOOL

This point was generally discussed by the reviewers by treating the single 15 Bev., high intensity part separately from the colliding beam synchroclash part.

Thirty-one reviewers commented on the research value of the single beam accelerator. All 31 replies were favorable, although 3 accelerator builders pointed out that if this machine were to be built only on the merits of its single beam operation it would be a most expensive way of accomplishing this goal.

Opinion on the research value of the clashing beam machine was divided. Thirty-nine reviewers commented on this point. Twenty indicated that they considered the proposed accelerator as a valuable tool for future high energy physics studies. However, eight qualified their opinion by pointing out that present detecting techniques would not be adequate and that the accelerator's research value would depend strongly upon the development of new experimental techniques. Nineteen reviewers questioned the research value of the machine.

Of the high energy experimentalists and theoreticians, 10 evaluated the research potential of the accelerator as good, though 6 qualified their evaluation by remarks about the dependence on yet unknown research techniques. Nine questioned the research value of the clashing beam machine.

Value as a research tool

	Good value	Clashing beams		Single beam	
		Good value if new detecting techniques are developed	Questionable value	Good value	Questionable value
Accelerator builders	5	2	9	8	
High energy experimentalists	2	5	4	12	
High energy theorists	2	1	5	6	
Elder statesmen	3		1	5	
Total [1]	12	8	19	31	

[1] The difference between the total shown here and the replies received represents the number of reviewers who did not comment on this particular question.

Quotations:

Single beam research value, positive.—"The increase in intensity of the single circulating beam of nearly 10,000 over existing machines should result not so much in better measurements of known characteristics, but the detection and measurement of quantities and attributes not known at present."

"I have only good things to say for the usefulness of single beams of high energy and intensity. Although single beams sound less spectacular I think that they may produce more exciting results. Here one can make secondary and perhaps tertiary beams which will often be of greater interest than the primary beam. Furthermore the events can be seen in the detector and good beam-to-background ratios will multiply the feasible detection techniques."

Clashing beam research value, positive.—"The idea of clashing beams and the technical ingenuity which has brought the idea close enough for serious examination are scientific contributions of high caliber. The energy range for which the machine is designed is one which must be explored."

"As far as use of clashing beams is concerned, it is at present the only way known to me to overcome the difficulty of the center of mass motion and I am confident that ultimately it might be possible to use clashing beams to great advantage. However, I expect that the use of such a new and unusual technique may take a long time to develop. I would think of several years and that the background problems and the poor definiteness of the source region are going to be major obstacles."

"Likewise, the enormous increase in effective energy available in the clashing beams should again result in entirely new and unanticipated discoveries."

"Synchroclash in general seems to offer a marvelous opportunity to study very high energies."

Clashing-beam research value, questionable.—"In contrast, the use of a MURA 2-way accelerator (besides being used as a 1-way accelerator) is rather limited. It should be pointed out that the study of multiplicity, angular distribution or energy dependence of production of known particles from a p–p collision with 30 Bev. energy in the center of mass system has only moderate interest at the present time."

"The usefulness of clashing-beam-type experiment depends, therefore, largely on the possibilities of finding new particles which, otherwise, cannot be produced. However, unlike the single-beam-type experiment, in order to find such particles they must be of both high production cross sections and relatively long lifetimes. Comparing with our previous discussions it seems that at present a single-beam-type experiment is, probably, more efficient in detecting possible new particles as compared to a clashing-beam-type experiment. Based on our present knowledge, the usefulness of a clashing-beam-type experiment in physics is rather questionable."

"Yet however bold the approach and however necessary the goal I do not believe that this is the path to the most exciting discoveries of the next decade."

COMPETENCE AND SIZE OF THE MURA STAFF

In reviewing this aspect, 32 scientists commented—unanimously praising the high technical caliber of the existing staff. As for the anticipated size of the

staff, 11 believed it to be too small and 4 pointed out that an especially large increase in engineering talent would be required. Many reviewers believed that MURA had underestimated the difficulty of building up the necessary large and high quality staff and management required to actually build the accelerator.

Quotations:

"The scientific quality of the university staff members forming the MURA group is of the highest and their abilities in design calculations for the present proposal are impressive in quality and scope."

"The technical abilities and competence of the existing MURA staff cannot be overly praised."

"The ability and skill of the available, and potentially available, senior staff of physicists have been demonstrated repeatedly. The impressive competence and ingenuity of the MURA group assure the satisfactory direction of a project of such magnitude and complexity. However, such a project will require an engineering staff many times the size indicated in the proposal. Recruitment of the large, high-caliber engineering staff will be one of the most difficult problems of project management."

COST ESTIMATES

Thirty replies covered the question of the expected cost of the facility. Twenty-one replies treated the construction cost estimates. All of them believed the $86 million estimate as being too low. The extent of the underestimate varied from 20 to 60 percent. Nine commented that the expected operating costs were considerably too low.

	Cost estimates	
	Construction cost—too low	Operatin cost—too low
Accelerator builders	12	3
High-energy experimentalists	5	5
Elder statesmen	4	1
Total	21	9

EFFECT ON OTHER EXISTING ACCELERATOR INSTALLATIONS AND OTHER AREAS OF RESEARCH

Nine reviewers expressed some concern as to how the possible construction of the MURA machine would affect other physics and the support of existing accelerators.

Quotations: "When considering the advisability of supporting other large accelerators, such as the MURA proposal, the first test should be whether or not this additional commitment by the AEC would decrease the funds available for supporting research operations in the existing and producing laboratories. If it leads to a rate of expansion of the research budget beyond that which could be justified and continued through congressional appropriations, it would almost certainly force a reduction (or failure to meet normal growth) of the accelerators in being. Such reduction might well cause more harm to scientific progress than could be compensated by the new facilities. The present budgetary difficulty of the Research Division in meeting the normal planned needs of existing accelerator laboratories is a vivid illustration of the kind of problems which may limit further large-scale construction projects."

"The considerable expenditures into which high energy physics is leading us can be and should be justified. At the same time it is necessary that similar big amounts of money be made available to other branches of science and particularly also to some applied fields. The MURA project makes sense in an overall plan in which all fruitful sciences have decent support."

SUMMARY

Summarizing, the question of technical feasibility seems to be uncertain with reviewers' opinions split about 50–50, although many of those expressing belief in feasibility based this on confidence in the successful outcome of future development. The feasibility of the high-intensity single-beam device seems

to be much better established. One-third of the accelerator builders recommended that at least the success of the 40 Mev. model be awaited before the construction authorization of the whole machine was made. The research value of the single-beam high-intensity machine was uniformly acclaimed, but several noted that if this were the main objective of the machine, it could be achieved at a lower cost than the clashing-beam machine; while opinions on the research value of the clashing-beam device were split about 50–50. The reviewers agreed uniformly on several points: (*a*) The excellence of the existing MURA group (but many emphasized the necessity of need for more staff, particularly on the engineering side, if construction is undertaken); (*b*) the underestimation of the construction cost estimates, and many believed that the operating costs were underestimated; and (*c*) the necessity for the continued support of the MURA group.

UNITED STATES ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.

The Atomic Energy Commission has received recently a proposal from the Midwestern Universities Research Association requesting support for the construction and operation of a high-energy research facility. This proposal supplements an earlier one dated April 5, 1956, which you were so kind to review for us.

In the light of your experience and interest in high-energy accelerators and in the research carried out with them, we would appreciate and value your review of and comments on this recent MURA proposal.

We are especially interested in comments on the following points:

(*a*) Does the proposal, together with your judgment of the current state of technical knowledge in this field, indicate that it is now technically feasible to construct and successfully operate the proposed accelerator? If your answer is negative or expresses doubt on this question, and you believe that further development work is necessary to demonstrate technical feasibility before making the decision to construct, will you please indicate the areas in which further effort is needed?

(*b*) Will you discuss and evaluate the research potentialities of the accelerator? Is it clear today that the clashing-beam experiments will be feasible and useful?

(*c*) Are the cost estimates as contained in the proposal realistic? In view of the past AEC experience with respect to preliminary cost estimates, your judgment on this question would be of particular interest.

(*d*) Are the technical abilities, size, and overall competence of the proposed staff such as to assure satisfactory handling of this project?

Your response to this letter will be used within the Atomic Energy Commission to assist it in reaching a decision on the proposed project. We will make every effort, should you so indicate, to assure that the contents of your letter are not disclosed outside the executive branch of the Government. Should you indicate that you wish your remarks to be kept confidential, we would like to know whether or not you would object if some of the statements contained in your letter might be quoted without revelation of the source.

Since the proposed MURA accelerator would represent a sizable commitment on the part of the Government to the future costs of high-energy physics, your assistance in helping us reach the appropriate decision will be sincerely appreciated.

Sincerely yours,

JOHN H. WILLIAMS,
Director, Division of Research.

Representative HOLIFIELD. Senator Proxmire is here this morning and has a short statement he wishes to make.

You may proceed, Senator.

STATEMENT OF HON. WILLIAM PROXMIRE, A UNITED STATES SENATOR FROM THE STATE OF WISCONSIN

Senator PROXMIRE. Congressman Holifield, I want to thank you very much for your courtesy in permitting me to appear this morning.

I am appearing in protest against the failure, as I understand it, of the Atomic Energy Commission to authorize funds for Midwestern University Research Association for the construction of an

atom smasher which, on the basis of everything I have been able to see and determine, has proven itself. In fact, the men most responsible have told me that there has been more experimental work proving the principles of that machine than any high energy accelerator that has ever been constructed.

The design for this machine is extremely ingenious. It is based on new principles that have been developed by the MURA group. The clashing beam accelerator was a great contribution to physics and it will enable, as I understand it, the construction of a machine that can get results for an infinitely lower cost than would be necessary using the traditional conservative methods. Nevertheless, it has proven itself so it is not a radical unproven scheme.

I think that a great deal of weight should be given the recommendation of the MURA people. As you may know, the Midwest University Research Association is a group that consists of some 15 midwestern universities, including every university that has a strong physics department in the Midwest. The people who head up the organization are recognized as competent, responsible, thoughtful scientists and they have been laboring under the great difficulty of having all the other accelerators located in either the east or west coast, which is very difficult for the physics department of the midwestern universities.

I would like to speak, in conclusion, on the site, and say that this Midwest University Research Association has settled on a site near Madison, Wis. This has been the result of a near unanimous vote of the midwestern university people. There were 11 sites considered, and it was agreed with near unanimity that the Madison site offered the best opportunity for constructing this accelerator most efficiently.

The site requirements are very rigid. It requires bedrock. There are scientific requirements that have to be met, and on the basis of very thorough and careful investigation covering quite a bit of time, it was decided that the Madison site was by far the best.

It seems to me that it is extremely important that the requests of the MURA people—that the site be honored and that also the control of the accelerator be left in the hands of some such group as Midwest University Research Association—be respected because as I understand the principal value of this accelerator is in pure research, and pure research can best be accomplished by a university group rather than a Government organization.

The principal arguments against proceeding at once with construction at the MURA site, have been two:

First, the time was not ripe for the construction of the accelerator because the principles had not been adequately proven for such a tremendous expenditure of money. I think this argument will be met and can be met by the people who are here today, ready, willing and able to testify.

Secondly, the site should be at Argonne so you could concentrate similar research at one place near Chicago.

On the basis of everything I have seen, there is no necessity for concentrating research at Argonne. The fact is that Argonne is quite a distance from the University of Chicago. It is 40 miles, but it is through a massive metropolitan area.

On the other hand, Kegonsa is very near the University of Wisconsin.

I have talked to a great many scientists, who will be necessary to make this work at the University of Wisconsin and other universities who would greatly prefer this location because they would be in a university community under much more attractive circumstances than a great metropolitan area like Chicago.

I want to thank the committee very much for your courtesy for permitting me to appear.

Representative HOLIFIELD. Thank you, Senator, for your statement, and you can be sure that the committee will give deep consideration to this project.

Senator PROXMIRE. Thank you, sir.

Representative HOLIFIELD. Before we adjourn, I would like to insert in the record the complete statement of the MURA witnesses, together with a statement of Representative Henry S. Reuss, from the State of Wisconsin.

(The statements referred to follow:)

STATEMENT OF R. ROLLEFSON, DIRECTOR, AND K. R. SYMON, TECHNICAL DIRECTOR, MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION

ORGANIZATION

The Midwestern Universities Research Association is a not-for-profit corporation incorporated under the laws of the State of Illinois in September 1954.

Its main objective is the establishment and operation of a research institute in the Midwest. This institute is to provide facilities (e. g., the finest high-energy accelerator) for research and instruction in the field of high-energy nuclear physics and is to be open to all qualified scientists who can make sufficient use of its facilities. A cooperative organization such as MURA is necessary for this endeavor since the necessary facilities in cost and manpower are beyond the capabilities of any single educational institution.

At the present time 15 educational institutions make up the principal members of the Midwestern Universities Research Association.

Iowa State College	University of Kansas
Purdue University	University of Michigan
Michigan State University	University of Minnesota
Northwestern University	University of Notre Dame
University of Chicago	University of Wisconsin
University of Illinois	The Ohio State University
State University of Iowa	Washington University of St. Louis
Indiana University	

As Senator Wiley has pointed out, we are here at his request to supply information to the committee regarding present status, plans, and needs of the MURA Laboratory. As you know, we have recently revised our proposal for a high-energy research facility (originally submitted to the Atomic Energy Commission, April 1956) to incorporate the results of the theoretical and experimental investigations which have been carried out at the MURA Laboratory during the last 2 years. The revised proposal has been sent by the Atomic Energy Commission to about 50 scientists for review and this review will probably be completed sometime in June. We were somewhat reluctant to appear before the Joint Committee at this time because of the possibility that our appearance might be misinterpreted. However, our program has been so misunderstood and statements have been published which are so confusing or misleading that we felt we should not pass up this opportunity to set the record straight.

The original MURA proposal described an accelerator which achieved colliding beams by means of two accelerator rings tangent to one another. Investigations since then have confirmed that this accelerator would perform as predicted in the proposal. However, it has been discovered that it is possible to make two beams circulate simultaneously in a single accelerator ring, thus achieving colliding beams in an essentially simpler manner. It now appears that this

is the preferable way to construct a colliding-beam accelerator and consequently this type is described in the revised proposal.

In the course of the MURA investigations two models have been built which have tested and confirmed all of the principles involved in the MURA proposal. A third model is now under construction which will do with electrons on a small scale essentially all of the things which we propose to do with protons in the large accelerator. This model should be completed within the year.

During this next year we intend to exploit the third model to the fullest possible extent to make sure that its behavior is in strict accord with the theory on which the proposed large accelerator is based. At the same time, we expect to continue with design calculations for the large machine and we hope to be able to construct models of actual components for the proposed accelerator, for example, models of the magnets and the accelerating mechanism. We have been encouraged to believe that the AEC will provide funds to support these activities.

If we can proceed without unnecessary delays, we should be able to order major components such as iron by early 1961 and complete final assembly during 1963. At the moment, however, we have no prospect of maintaining this schedule. One of the first requirements for doing so would be to begin construction of a laboratory building almost immediately. The garage which we are now using as a laboratory is barely adequate for the model work and component development that we have scheduled for the present year, and will be totally inadequate to continue the program beyond another year. We will therefore need a laboratory building ready for occupancy a year from now. It goes without saying that we cannot build a laboratory without a place to put it, and this furnishes the first reason why the question of site on which there has unfortunately been so much misrepresentation and misunderstanding cannot be postponed much longer.

A second reason for urgency in settling the site question is that the final plans for the accelerator cannot be drawn until the site is known, and until very careful studies of the geological characteristics, load-bearing qualities, etc., have been carried out. Such studies could well occupy a period of a year or more. One could not think of asking an architect to design a building without telling him where it is to be built, and yet the design and performance of a large-scale accelerator depend much more sensitively upon the geological characteristics of the site.

Finally, it is necessary to settle on a site for the sake of the personnel who are to construct and operate the accelerator. Present and prospective employees are justifiably very much concerned with knowing where the project will ultimately be located. Since so much incorrect information has circulated regarding the choice of a site by MURA, a short review of the actual procedure would probably be of interest.

When, in November 1955, MURA was asked by the AEC to design and construct the world's finest accelerator, a site committee was set up which made a very careful and thorough investigation of possible sites in the Midwest. This committee had the help of some of the foremost foundation experts in the country. All of the member universities were invited to suggest sites and 11 proposals were received, some of them containing more than 1 possibility. After a thorough study of the proposals the committee made an independent investigation of the most promising possibilities and final reported back to the MURA board. On the basis of the report of the committee, the advice of the technical group, and independent study of the proposals, the members of MURA chose three of the proposed sites for submission to the Commission for consideration. Of the three, the site near Madison was the overwhelming favorite of the MURA members and was so reported. This has continued to be the position of the MURA universities on the matter of site.

The criteria which were important in the selection of site varied somewhat from member to member. However, there were a few which were of major importance and of these the nature of the foundation was probably first. For an accelerator of the type proposed, the magnets must be kept in place to about one one-hundredths of an inch in a circle nearly one-fourth of a mile in diameter. The advice of all authorities was that bedrock, preferably sandstone, was so superior to other possibilities that it would probably be very unwise to gamble with anything else. All three of the recommended sites conformed to this requirement.

A second criterion was proximity to a university and to a university community. It was appreciated that some of the principal ties which hold out-

standing men in the universities in spite of more remunerative possibilities elsewhere are their enjoyment of associations with faculty and students in the university, the advantages of raising their families in a university community, and the presence in a university of library and research facilities, outstanding scholars, and a variety of activities encompassing all areas of human knowledge.

The controversy regarding site which has been impeding progress for the last few years can perhaps be described as follows. The MURA scientists feel that, having developed the principles of the new accelerator, they are the logical group to design and build it if one is to be built. The AEC, on the other hand, believes that the project is of such a magnitude that it ought to be carried out by an existing national laboratory and therefore proposes that it be built at the Argonne Laboratory. However, there does not appear to be any practical way of building the accelerator at the Argonne other than for MURA to give up its operation of the project and for the Argonne to organize a group to carry on the work. On this both the AEC and MURA are agreed. Although it is probable that under these circumstances some of the present MURA personnel would transfer to jobs at the Argonne, the MURA people feel that this would involve a considerable loss of time and momentum, as well as loss of competence and morale in the group. Furthermore, such a policy would in the future discourage the formation of other groups for the purpose of developing new ideas.

An additional point on which there has not been complete agreement involves the organizational structure of the laboratory. The MURA position is that an instrument of this type to be used for pure basic research can most easily and efficiently be built and most effectively be used if it is operated by the cooperating universities as a university research laboratory. This is a principle which has been found successful at the Brookhaven Laboratory which is operated by the Associated Universities, Inc., a group of eastern universities. The MURA organization has been patterned after the eastern AUI organization. It is our hope to make use of Brookhaven's experience in order to improve where possible upon this organizational concept. We believe that an organization in which each university has both responsibility and authority is most likely to make full use of the scientific potential of the universities. During the 5 to 10 years that the accelerator would be under construction, the MURA organization would be able to draw upon the large pool of scientific talent represented by the universities throughout the Midwest. We also believe that basic research should not be divorced from the educational process. A high energy facility operated as a university laboratory could be made available to university faculty and advanced graduate students and would serve a very important educational as well as a research function.

In view of some unfortunate publicity which has appeared, we want to make clear that we are not criticizing the Argonne Laboratory. We believe that it is performing its useful functions very well indeed. We should like to point out that since the earliest days of MURA Argonne scientists have made valuable contributions to our technical discussions, and we have always had friendly cooperation from Director Hilberry and his staff.

However, much as we believe in the Argonne, we are strongly opposed to the idea that all expensive scientific activity in a particular field must be concentrated in one installation. The failure of the German atomic bomb program during the war can be ascribed directly to the fact that they had a single man in control of the whole program and although he was probably the best man for the job, the course he chose happened to be the wrong one. It is important to consider very carefully whether the possible economies and other alleged advantages to be gained from locating all interuniversity research at one location under one management are really sufficient, in comparison with the disadvantage and risks involved, to justify setting up a monolithic research institution to control all such activities in the Midwest. Whatever may be the case with regard to development and production activities, we believe that basic research proceeds most rapidly and successfully when it is carried on by as many competent and independent research groups as can economically be supported.

In conclusion, we would like to express the hope that when the responsible authorities are convinced of the feasibility of the proposal we have submitted, it will be possible for us to get assurance that the Government intends that we should carry the project through to completion. Scientists who work on a project such as this are staking a great many years of their productive lives on the ultimate success of the project. They have sufficient confidence in the technical feasibility of the program to be willing to do this, but it is unreasonable

to ask them to continue indefinitely when no assurance that they will ever be able to carry the work to completion.

What is needed is an early decision on site and an authorization which will allow us to proceed with each phase of the project in an orderly fashion, to complete the detailed accelerator design, to carry out foundation studies on the chosen site, to begin construction of buildings so that they will be completed when needed. Actual expenditure of large sums of money on major components of the accelerator need not come for another 2 years during which time further studies and improvements will be made which will afford even greater assurance of the success of the project.

STATEMENT OF HON. HENRY S. REUSS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WISCONSIN, MAY 28, 1958

Mr. Chairman, I regret that other commitments prevented me from attending this subcommittee's hearing on Tuesday, May 27, when representatives of the Midwestern Universities Research Association gave testimony concerning the large-scale accelerator proposed to be built and operated by MURA near Madison, Wis. I appreciate the opportunity to submit this statement in support of the testimony given this subcommittee by Senator Proxmire, Senator Wiley, Dr. Rollefson, Dr. Crane, and Dr. Symon.

I certainly am not an expert on high-energy physics. But these MURA scientists are. They are among the best in the world, and they have an organization that has made a tremendous breakthrough in their field. This is obvious when they tell us of their machine having an expected energy equivalent of 540 billion electron volts. The MURA scientists all agree that they are ready to go ahead with the type of accelerator they now propose.

I think it is important not only to assure continuance of the MURA group's work, but to speed up this project in every possible way. There have been too many delays encountered up to now. As Dr. Rollefson told you, the MURA organization has previously been on the verge of disappearing, and is in constant danger of losing key members of its team unless it has an assured future.

The Joint Committee on Atomic Energy should, I believe, direct the Atomic Energy Commission to reconsider its total position toward MURA, and should authorize the necessary funds for MURA to go ahead not only with its technical work but for the laboratory construction at the Madison site in 1959.

The advantages of the Madison site have been fully presented to you. The advantages over Argonne are very clear, it seems to me. Even if all other things were equal, such as bedrock conditions, I subscribe to the view that we should not concentrate all facilities of this kind at a Government laboratory under direct Government control. Many of these projects can be better carried out by an organization such as MURA in a university atmosphere and under control of the universities.

Gentlemen, I urge the Joint Committee to give the MURA project the highest possible priority. I don't believe the United States can afford to lose more time on it.

Representative HOLIFIELD. The meeting is adjourned.

(Thereupon, at 12 noon, Tuesday, May 27, 1958, the subcommittee adjourned, to reconvene Wednesday, June 4, 1958, at 10 a. m.)

27254—58——14

AEC AUTHORIZING LEGISLATION

WEDNESDAY, JUNE 4, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to call at 10 a. m., in room 318, Senate Office Building, Hon. Chet Holifield, chairman of the subcommittee, presiding.

Present: Representatives Holifield, Durham (chairman of the Joint Committee), and Van Zandt; Senators Gore, Hickenlooper, and Dworshak.

Also present: James T. Ramey, executive director; David R. Toll, staff counsel; R. N. Nelson, staff technical adviser; George E. Brown, Jr., and George Murphy, staff members, Joint Committee on Atomic Energy; and Bernard V. Dvoskin, GAO consultant.

Representative HOLIFIELD. The subcommittee will be in order.

The purposes of the hearings of the Subcommittee on Legislation of the Joint Committee on Atomic Energy beginning today are to consider the AEC request for authorization for reactor facilities and the cooperative atomic-power program for fiscal year 1959, and to review the Commission's and the committee's views on the long-term civilian power-reactor program.

As most of you know, the Joint Committee postponed any extensive discussion on the atomic-power program during the statutory 202 hearings last February in order to permit informal discussions between the Commission and the committee to continue.

The Subcommittee on Legislation has also postponed consideration of reactor projects until the latter part of its hearings in order to permit the Commission to come up with as definitive a statement as possible, both for its 1959 operating programs as well as its 1959 construction program and the long-term atomic-power program statement.

It is regretted that consideration of this important program has been delayed for such a period of time. This, apparently, has been due, in part, to difficulties with the silent party in our negotiations; namely, the Bureau of the Budget. But we have reached the stage where we must hold our hearings and authorize facilities and a program for fiscal 1959 in the next few weeks in order for the Congress to pass any legislation on atomic power in this session. In short, we are at the stage where we must "fish or cut bait."

A good deal of water has gone over the dam since our hearings were held last year on authorization legislation. Let me call your attention to certain key facts which have been pointed out by a number of independent studies in addition to the Joint Committee's own

efforts. Perhaps the best digest of these facts is contained in the summaries of seminars held by the Joint Committee with reactor experts and industrial representatives, date November 21 and 22, 1957.

I would like to quote from the first six points of the summary with the reactor experts by way of background information on our current situation:

1. There is today no clear-cut Government program with regard to atomic power development. We need clear-cut national objectives, both with respect to domestic and international development.
2. The AEC power demonstration program, as it now exists, is not by itself proving adequate for the work that has to be done. Additional funds and efforts will be required if we are to develop nuclear power technology at a rate sufficient to meet the needs of national and international policies.
3. Private industry alone cannot carry the full load in developing and constructing reactors. More Government support and money is necessary.
4. Availability of technical manpower is not today a limiting factor in developing reactor technology.
5. The Government should determine and firm up how much money it is willing and plans to spend within the next several years in the civilian power program (This could be a 5-year or a 10-year plan.) Once having made that determination and it is known how much money will definitely be allocated to the program over a given period of time, details can then be worked out as to how the money will be spent to cover the various elements of the program.
6. It will be only after several succeeding generations of full-scale reactors of a given type before we will succeed in reaching or approaching the stage where the economic value of a reactor concept can be determined.

It was in the above context that Chairman Durham of the Joint Committee requested AEC to join in the informal development of some realistic program objectives and an accelerated program to carry them out. The Commission accepted this invitation, and considerable progress has been made towards a definition of objectives. Progress has also been made on the scope of the program. But, as we shall see, there are questions still to be resolved as to the methods of getting the job done.

With Chairman Durham's permission, I would like to mention the principal outstanding issues, since they will be discussed at least in part in the hearings beginning today:

First is the so-called plutonium buy-back problem. It is understood that the chairman of the Joint Committee will request an AEC legislative proposal on this matter at the conclusion of the hearings on the domestic and foreign atomic power program. Informal discussions have revealed that there should be some basis of agreement between the committee and the Commission on this problem. (For correspondence on this subject, see appendix, p. 433.)

Second is the role of the government and industry with respect to specific prototype reactor projects. This issue has been narrowed considerably. But there is still some fuzziness as to the Commission's position on this question with respect to such reactor projects as the proposed graphite moderated gas-cooled reactor.

Third, the policies with respect to the power reactor demonstration program will require greater definition. These policies have not been discussed in any definitive extent with the Commission in connection with the long-term power program. However, they have been considered in connection with certain private reactor demonstration projects such as that of the Pennsylvania Power & Light Co.

Fourth, and finally, there is the question of the scope and extent of AEC support for the immediate and the long-term atomic power program as expressed in financial and budgetary terms. We will have to

consider whether the development of some financial level of support is necessary to give a real understanding of what the Commission's future plans are.

It is understood that the Commission will lead off today's hearing with a statement on its views on a long-term atomic power program. Staff members of the Joint Committee have informally reviewed earlier drafts of the Commission's statement, but committee members have not had an opportunity to discuss it with Commissioners or members of the AEC staff. As a matter of fact, the committee did not receive a statement from the Commission until Monday morning, and this statement was in effect withdrawn on Tuesday, to be replaced in part late yesterday.

The committee staff, at the request of Chairman Durham and myself, has also been preparing a draft statement to reflect more adequately the committee's views on the long-term program.

In view of the above circumstances, the committee will regard the AEC statement as a tentative proposal as to various policies and projects, particularly in relation to the long-term program. I hope that, as a result of our hearings and possible further informal discussions, a mutually satisfactory long-term program statement can be agreed upon.

(For addresses by Representative Durham and Senator Anderson on the atomic power program, see pp. 423 and 428.)

In connection with review of the AEC statement, I would like to submit the following questions for consideration:

1. Will AEC provide the leadership and drive to see that the objectives which they set forth are accomplished in practical results?

2. (*a*) Is the financial level of support requested for fiscal 1959 and projected estimates through fiscal 1963 sufficient to carry out the objectives set forth?

(*b*) In this connection, we will want to compare AEC's original request to the Bureau of the Budget with what is now officially proposed.

3. Should not the AEC power reactor demonstration program be reconstituted to provide for greater leadership and direction by the Commission in such matters as designation of projects and followup on their accomplishment?

As a summary of the questions which I believe should be considered in connection with the AEC statement, I would like to inquire as to whether the Commission would subscribe to the following policy statement as a part of its long-term program and policy:

The United States Government considers the objectives of this program of great importance from a national and international standpoint, and the AEC will provide positive leadership to make certain that the objectives are achieved in terms of the practical results. The leadership to be provided by the Commission during the next 5 to 10 years will be accomplished in a variety of ways, including the following:

(*a*) Continuance of responsibility by AEC for the conduct of the base program of research and development through its national laboratories, industrial contractors, universities, and nonprofit institutions.

(*b*) Assumption by AEC of positive direction of the reactor development program from the state of feasibility studies of promising reactor concepts, through the necessary reactor experiments and pilot plants, up through the construction and operation of experimental prototype reactors. Large-scale demonstration plants would also be constructed if not otherwise provided by industry.

(*c*) Provision of positive direction by AEC of the private power demonstration program by the selection by AEC of the reactors to be designed and con-

structed, the setting of realistic dates for submission, approval, and negotiation of proposals for each project; and the prompt assumption of responsibility by AEC for construction of the project in the event a satisfactory proposal is not received, or if negotiations lag unduly, or if the construction project is not undertaken by the private party.

I regret that I had to take as much time as I did in my opening statement, but believe that it was necessary to do so in order to provide a proper framework for our hearing.

Without objection, I would like to insert into the record certain documents and correspondence relating to the development of the current consideration of the atomic power program, including the summary of the seminar of the reactor and industrial experts, dated November 21 and 22, 1957; Chairman Durham's letter to the Commission dated November 27, 1957, and Mr. Strauss' reply dated December 6, 1957, together with subsequent correspondence on the subject.

(The documents referred to follow:)

JOINT COMMITTEE ON ATOMIC ENERGY

RESEARCH AND DEVELOPMENT SUBCOMMITTEE

SUMMARY OF SEMINAR WITH REACTOR EXPERTS, NOVEMBER 21, 1957

On November 21, 1957, a closed, informal seminar was held in room F–88, the Capitol.

On the basis of this seminar, of which no transcription was taken, the following conclusions were reached:

1. There is today no clear-cut Government program with regard to atomic-power development. We need clear-cut national objectives, both with respect to domestic and international development.

2. The AEC power demonstration program, as it now exists, is not by itself, proving adequate for the work that has to be done. Additional funds and efforts will be required if we are to develop nuclear-power technology at a rate sufficient to meet the needs of national and international policies.

3. Private industry, alone, cannot carry the full load in developing and constructing reactors. More Government support and money is necessary.

4. Availability of technical manpower is not, today, a limiting factor in developing reactor technology. There are, however, some instances where temporary shortages of highly skilled people occur, but these deficiencies are in cases where the skills can only be acquired through work and experience in the field itself.

5. The Government should determine and firm up how much money it is willing and plans to spend within the next several years in the civilian power program. (This could be a 5- or 10-year plan or comparable.) Once having made that determination and it is known how much money will definitely be allocated to the program over a given period of time, details can then be worked out as to how the money will be spent to cover the various elements of the program.

6. In developing reactor technology, it is necessary to build reactors large enough to develop the necesary technical information, and there must be several succeeding generations of a given type if we are to prove out that type. In building full-scale reactors, it is usually necessary to go through the following steps:

(*a*) Small experimental model.
(*b*) Intermediate size.
(*c*) Full-scale project.

It will be only after several succeeding generations of full-scale reactors of a given type before we will succeed in reaching or approaching the stage where the economic value of a reactor concept can be determined.

7. We should continue to give strong support to advanced reactor concepts and the necessary research and development work involved in these advanced concepts. We must not drop them or cut back on them to specialize only on the water types.

8. Additional research and testing reactors (similiar to MTR and ETR) need be built by the Government. We cannot depend entirely upon private industry to build and support research and test facilities. This includes hot cells and

supporting equipment. Industry often has excess capacity in its own facilities, but competitive considerations have a tendency in some instances to discourage the use of one firm's facilities by another.

9. The Government must support wide engineering research of a type that cuts across the entire field and is not limited to one of several particular reactor concepts. Such research is an essential part of our reactor development effort and should be utilized to the maximum to prove out materials and components which would otherwise have to receive their preliminary tests in more costly full-scale reactors.

10. There are too many small subcritical research and development organizations in the nuclear-power field at the present time, which tend to dilute effort and trained manpower. Some suggestions were made as to consolidating efforts through joint enterprises comprised of several organizations.

SUMMARY OF SEMINAR WITH REPRESENTATIVES OF EQUIPMENT MANUFACTURERS NOVEMBER 22, 1957

The Research and Development Subcommittee held an informal seminar November 22 with representatives of the equipment manufacturers to discuss the nuclear-power program. No transcript was made of the proceedings, which were held in the committee room at the Capitol.

Following are some of the major points covered:

1. Need for well-defined policy

There was unanimous agreement among the participants, as there was at the reactor experts' seminar the previous day, that the most pressing requirement at the present time is a clear and well-defined statement of this country's policy in the nuclear-power field, both from a domestic and international point of view. It was agreed that such a statement of policy by the Government is a necessary prerequisite to the development of an intelligible and effective program of action to further this country's objectives. Without such guidance, participants in the program cannot move forward confidently and the program has a tendency to drift rather than move vigorously ahead.

2. Desirability of fixed-income contracts

There was virtually unanimous agreement that the concept of fixed-price contracts for research and development work is unworkable and undesirable. It was pointed out that research and development necessarily implies a high degree of uncertainty in initial cost estimates, and that it is not reasonable to expect the manufacturer to absorb the entire difference between original estimates and final costs, particularly where such differences may range up to 100 percent or more. It was suggested that cost-type contracts were more suitable for the construction of first-generation prototype nuclear powerplants, which involve considerable research and development costs. It was also felt by some that the "buying in" concept by which the manufacturer contributes a portion of the funds for a powerplant project was not desirable as it limited manufacturer participation to those companies with large financial resources.

3. Desirability of subsidies

Several participants suggested that direct Federal subsidies would be desirable as a means of accelerating the atomic-power program. Such subsidies could take the form of payment by the Government of the difference between the costs of conventional powerplants and nuclear plants, either in full or in part. Another suggestion was that the subsidy be based on a fixed payment for kilowatts actually produced, although this received little support by the group. Both suggestions, to be carried out, would require amendment of the no-subsidy provision of the 1954 Atomic Energy Act.

4. Shortage of manpower

It was generally agreed that there does not now exist any real shortage of scientific and engineering manpower in industry. It was noted that all companies traditionally run slightly short of such manpower as a matter of good management, and in some instances temporary difficulty is experienced in finding exactly the right man for a given technical assignment. As a general proposition, however, the manufacturers consider present supplies of manpower adequate and in some cases surpluses are developing where business has slackened off. All agreed that the present adequacy of manpower supplies in no way detracted from the long-term need for skilled manpower and for im-

provements in our educational system to insure that our young people have the necessary preparation to pursue careers in science and engineering.

5. Need for more test equipment

It was generally agreed that progress in atomic power development rests in considerable degree on preliminary studies and performance data on component parts derived from experimentation in engineering and test reactors, and other large testing equipment. This is particularly true, it was pointed out, in the case of fuel elements. There was some division of opinion as to whether additional equipment should be provided in the national laboratories or whether industry should expand its own facilities. It was noted, in this connection, that excess capacity may exist in test equipment being constructed by private industry but that competitive considerations often inhibit one firm from utilizing the facilities of another firm for test purposes.

6. Technical information program

It was felt that the Commission's technical information program is in general adequate although there was some feeling that there is still considerable material in laboratory files which has not yet been made available. Particular reference was made to the difficulties being encountered by some interested firms in obtaining information on reactor development from the Naval Reactors Branch of the Commission. Reasons given by the Naval Reactors Branch for refusing access to such information have been security considerations and also unwillingness to devote the necessary time to informational activities. Some difficulty is also being experienced in gaining information on the aircraft nuclear propulsion program.

7. Reactor markets abroad

It was pointed out by several participants that there is considerable misunderstanding regarding the prospects for sales of American reactors abroad. Too often we tend to think of the needs of other countries in American terms rather than in terms of what is actually required by the particular country involved. Thus, in a number of instances, the export of American know-how and cooperation with scientists and engineers in a given foreign country will be more important than the export of actual equipment. There are few cases anticipated where entire reactors, including building materials, will be exported. However, it was pointed out that a certain amount of equipment will inevitably be connected with the export of know-how and that, therefore, over a period of time there will be a demand for substantial quantities of hardware in the form of component parts. It was felt that greater progress would be made in the foreign market through cooperative arrangements worked out between American and foreign industry than on a government to government basis, as in the case of the British.

8. Indemnity coverage for reactors abroad

It was generally suggested among those equipment manufacturers doing business abroad that the lack of insurance/indemnity coverage for American firms is serving as a deterrent to them in considering foreign sales. However, no one had any answer to the observation that Government and power operators in foreign countries were satisfied that the insurance problem could be solved without United States legislative intervention.

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C., November 27, 1957.

Hon. LEWIS L. STRAUSS,
Chairman, United States Atomic Energy Commission,
Washington, D. C.

DEAR CHAIRMAN STRAUSS: Since Congress has adjourned, various members of the Joint Committee on Atomic Energy have been in close touch with the atomic power development program through overseas visits with European reactor experts, individual visits from members of the domestic atomic power industry and Government officials, and our recent informal executive sessions with leading AEC laboratory experts and industrial executives. We have also noted the recent reports of such representative groups as the Arden House Conference and the National Planning Association.

From these discussions there appears to be considerable confusion as to what our objectives and policies are, and should be. However, the general consensus seems to be that the current atomic power development program is not adequate, particularly if we take into account the objective of world leadership in reactor technology.

These discussions and observations have all pointed to the overriding need for a reappraisal of our policies and more precise definition of the policy objectives in the atomic power development program, both from a domestic and international standpoint. Once these policy objectives have been defined, then it is believed necessary to formulate a realistic and well-balanced program designed to carry out these objectives adequately.

I believe it would be in the national interest for the Commission and the Joint Committee to cooperate in clarifying our program objectives and in developing a program and methods of carrying them out. To that end I would propose a series of informal sessions between representatives of the Commission and the Joint Committee and its staff to explore areas of possible agreement and methods of cooperation in defining objectives and means of implementation.

Perhaps the best approach might be similar to that used in the case of the original 5-year program, which was developed by the Commission in cooperation with the Joint Committee and incorporated in a Joint Committee report. You may recall that in my speech at the Vallecitos Laboratory dedication on May 22, 1957, I made a recommendation along this line as follows:

"Now this is not the first time that the Joint Committee and the Commission have faced urgent problems in our atomic energy program. Back in 1953 the atomic power program was just getting underway and was faced with similar cutbacks in funds and a lack of direction characteristics of today. At that time the Joint Committee under the leadership of Sterling Cole and the late Carl Hinshaw of your State helped chart a progressive course by calling for the establishment of what has become the 5-year experimental reactor program * * *."

"It has occurred to me that after we try to take care of our immediate acceleration problems in Congress this year, perhaps the Joint Committee should sponsor the development of a 10-year demonstration power reactor program. This program might begin to take over where the 5 year experiment reactor program leaves off. It should provide a long term assurance to private atomic equipment companies and private and public power organizations of a stable and steady amount of Government financial support and assistance for atomic power development during this crucial development period for private industry."

You appreciate of course that the above statement represented my personal views. Since that time the need for a definition of objectives and program in the atomic power field has been recognized in the Joint Committee's report on the AEC authorization bill (H. R. 8996, 85th Cong., 1st sess.), in statements by various Members, and others as outlined earlier in this letter.

If the Commission is receptive to the above general approach, I believe the first step (after necessary preliminaries) would be for your staff to prepare a draft statement of proposed policy objectives and level of support of the civilian atomic power program, domestic and international, for review by the Joint Committee and its staff. It is hoped that we may obtain some informal clarification in this way before the work of the next session formally gets underway.

A number of considerations must be taken into account in developing such objectives. Thus, for example, the assumption by the United States of a role of world leadership in many fields, including the peacetime application of atomic energy, may impose many obligations on us and our economy which we would not otherwise undertake. A further factor to take into account is that in our own interest there may be great need for United States assistance in atomic power development to the energy-short free world through such agencies as EURATOM, and the International Atomic Energy Agency as well as by direct bilateral agreements. Then, of course, the very real threat of Soviet technical progress to our leadership is also a serious challenge, both psychologically and to our military survival. Finally there is the long term domestic need for developing economic atomic power to supplement conventional fuels. In my personal opinion and without prejudging our proposed reappraisal it is in this context that we must define our objectives and program in the field of atomic power.

Sincerely yours,

CARL T. DURHAM,
Chairman.

UNITED STATES
ATOMIC ENERGY COMMISSION,
Washington, D. C., December 6, 1957.

Hon. CARL T. DURHAM,
House of Representatives,
Washington, D. C.

DEAR CHAIRMAN DURHAM: This is to acknowledge with thanks your letter of November 27 and to express the satisfaction of the Atomic Energy Commission at the interest of your committee in cooperating with the Commission to further the position of leadership which the United States enjoys in the field of nuclear power.

While I regard our nuclear power policies and objectives as both clear and sound and our progress toward them satisfactory, and while I have not noted in others the degree of uncertainty regarding them, which you apparently have, I most certainly agree that the Commission and the committee have a duty to work together to dispel any confusion which has arisen, for whatever reason and from whatever source concerning them. I likewise feel that the fact of the passage of time and the consequent change in circumstances which the passage of time brings with it require both periodic review and a continual justification of objectives, policies, and programs and that it is important for our national atomic energy program that it should have the support of the committee, the Commission and the public so as to insure our continued progress and world primacy.

You are aware that we have just finished 3 days of conferences with members of various segments of the nuclear power industry. As soon as we have had a chance to digest these meetings, even preliminarily, one of us will call you to set up a meeting at a mutually convenient time. I have to leave for the NATO conferences in Paris toward the end of next week but I would hope that you would feel such a meeting with the Commission could take place whether or not I am available.

With best personal regards.

Faithfully yours,

LEWIS L. STRAUSS.

UNITED STATES
ATOMIC ENERGY COMMISSION,
Washington, D. C., December 20, 1957.

Hon. CARL T. DURHAM,
Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: Enclosed is a short note summarizing our pleasant discussion on Wednesday. We look forward to the next meeting, and I am sure the chairman will be in touch with you about the date.

Sincerely yours,

W. F. LIBBY.

At the informal meeting on December 18, 1957, which was at the suggestion of Chairman Durham, Messrs. Durham, Hickenlooper, Van Zandt, and Jenkins from the Joint Committee, and Messrs. Libby, Graham, Floberg, Vance, and Fields from the Commission, agreed that a maximum effort should be made to formulate a reactor development program which both the Joint Committee and the Commission could support wholeheartedly in the forthcoming session of Congress.

Responding to suggestions from many participants in the industry conferences held by the Joint Committee and by the Commission there was considerable discussion of what would constitute a proper statement of objectives for a comprehensive reactor development program.

The following was proposed and, as a working paper, met with no objection:

Objective No. 1.—Achievement of competitive nuclear power in the United States as soon as practicable and long before an economic need for it exists. By comparison with other objectives this one will be harder to reach because of the low level of conventional power costs at home. It should be considered as a long-range objective. If a timetable is necessary, 10 years should be set for this objective.

Objective No. 2.—Render maximum help to our foreign friends, particularly our NATO allies, in their programs to achieve nuclear power in quantities as

soon as possible. Because of its importance to their basic economies curtailment of the need for increasing importations of fossil fuels will not brook delay. By comparison with our first objective this one will be easier to achieve in terms of competitive nuclear power because of the higher cost of conventional power abroad. Furthermore, this objective contains an element of urgency which does not exist at this time in our first objective. This second objective should be considered as a short-range one. In a timetable it should be set down for 5 years.

Objective No. 3.—Fortify the position of leadership of the United States in the eyes of the world in the peaceful applications of atomic energy, particularly with regard to power. This is important in maintaining and increasing a close relationship with our foreign friends, particularly our NATO allies, on a base much broader than a purely military one. To serve this particular objective adequately we may be required to include in our domestic and foreign programs projects which otherwise would not be required. This objective emphasizes the need for a comprehensive program of assistance to our foreign friends clearly stated and vigorously pursued. Objective No. 3 is important from both a short-range and a long-range standpoint. In a timetable it should be considered as requiring results as soon as possible and continuing thereafter for an indefinite period.

Objective No. 4.—In the belief that we should be required to substantially increase our production capability of reactor products in the immediate future and our belief that the need for them will continue for a long time to come, we should seek to take advantage of the opportunity to combine this purpose with another one so that we shall at the same time increase our reactor products capability and provide more Government assistance to the building of power reactors both at home and abroad. This objective, like the preceding one, in the timetable should commence to show results as soon as possible and to that extent is short range in character, but it must also be regarded as a long-range program as well.

Chairman Durham suggested, and it was agreed, that with this statement of broad objectives before them, the staff of the Joint Committee and the staff of the Commission should develop without delay proposed means for implementing these objectives and that another meeting between members of the Commission and members of the Joint Committee should be held shortly after the beginning of the new session of Congress on January 7, 1958.

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
January 31, 1958.

Hon. LEWIS L. STRAUSS,
Chairman, United State Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: This is with further reference to Dr. Libby's letter of December 20, 1957, which summarized our luncheon discussion of December 18, 1957, concerning objectives of an expanded atomic power program.

As you know, this discussion grew out of my letter of November 27, 1957, which suggested that the AEC and the Joint Committee and their respective staffs should informally develop an accelerated atomic power program on a cooperative basis prior to public hearings.

Since receipt of your original acceptance of this approach on December 6, 1957, at my request our executive director has offered several times to collaborate with the Commission's staff in developing a draft of a mutually acceptable program statement to carry out the objectives. He also indicated, with my concurrence, that even the development of a statement of alternative approaches would be a helpful first step in implementing the objectives discussed in the December 20, 1957, letter. He also requested certain program information on past and contemplated expenditures on the atomic power program which would be useful to the committee.

All of the above requests were in line with the last paragraph of Dr. Libby's summary of December 20, 1957, which stated:

"Chairman Durham suggested, and it was agreed, that with this statement of broad objectives before them, the staff of the Joint Committee and the staff of the Commission should develop without delay proposed means for implementing these objectives and that another meeting between members of the Commission

and members of the Joint Committee should be held shortly after the beginning of the new session of Congress on January 7, 1958."

I regret to say that to date none of our above offers and requests for cooperation has resulted in any collaboration on the part of the AEC. This situation is particularly distressing in view of the fact that the Commission is already publicly taking a position on the "buy back" of foreign plutonium which is bound to have a profound effect on the domestic and foreign civilian atomic power programs.

I should like to point out further that our public 202 hearings are scheduled to begin on February 19, 1958, which gives us precious little time to achieve any basis of understanding.

However I should like to reiterate that the committee and its staff are always ready to cooperate in this and other worthwhile endeavors.

Sincerely yours,

CARL T. DURHAM, *Chairman.*

Representative HOLIFIELD. It is understood that Commissioner Vance will lead off for the Commission today.

We are very glad to have you with us, Mr. Vance. Since this is rather a long statement, I believe it would be desirable for committee members and its chairman to feel free to ask questions at any point in the statement.

STATEMENTS OF HAROLD S. VANCE, COMMISSIONER; JOHN S. GRAHAM, COMMISSIONER; JOHN F. FLOBERG, COMMISSIONER; W. K. DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; DON BURROWS, CONTROLLER; F. J. McCARTHY, ASSISTANT CONTROLLER FOR BUDGETS; L. OLSON, GENERAL COUNSEL; A. TAMMARO, ASSISTANT GENERAL MANAGER FOR RESEARCH AND INDUSTRIAL DEVELOPMENT; U. M. STAEBLER, DIVISION OF REACTOR DEVELOPMENT; AND DELMAR MORRIS, DIVISION OF REACTOR DEVELOPMENT, ATOMIC ENERGY COMMISSION

Mr. VANCE. I would like to observe at this point, Mr. Chairman, that I think the statement you have just read is very constructive and will help us to reach a conclusion out of these hearings.

With your permission, I will now read for the record the statement which we prepared.

Representative HOLIFIELD. You may proceed.

Mr. VANCE. Mr. Chairman and members of the committee, the Atomic Energy Commission and members of its staff are appearing before you today to review the proposed authorizing legislation contemplated by section 261 of the Atomic Energy Act for the civilian power reactor program.

Before proceeding with the discussion of the items included in the authorization bill, we thought it appropriate to give you a statement regarding the Commission's civilian power reactor program.

On July 31, 1953, the Joint Committee on Atomic Energy requested that the Atomic Energy Commission prepare an outline of its objectives in the field of reactor development over the ensuing 5 years, and a program for reaching these objectives.

The Commission submitted its statement of objectives and proposed program to the committee on February 5, 1954. The Commission's plans were endorsed by the full committee on March 23, 1954.

The original program has undergone a number of modifications during the past 4 years. New experimental power reactors have been

added to the program; research and development on materials, processes, and advanced concepts have been expanded; and the cooperative industrial efforts have materialized as an important part of the program.

We have gained considerable experience in the design and construction of power reactors during these 4 years of concentrated effort, and we are beginning to accumulate necessary operating experience. In short we, the AEC and industry as a whole, have achieved a considerable degree of sophistication in power-reactor technology. We are proud of our record of accomplishment, which we believe has kept the United States in a position of world leadership in this field.

The Commission appreciates the cooperation, encouragement, and stimulation of the Joint Committee on Atomic Energy which made this program possible.

The chairman of the Joint Committee on Atomic Energy, in a letter to the Chairman of the Atomic Energy Commission, dated November 27, 1957, suggested that the Commission and the committee "cooperate in clarifying our program objectives and in developing a program and methods of carrying them out."

We have developed this present statement following a series of discussions between members of the Commission and the committee and our respective staffs. We agree it is altogether appropriate, as the initially defined period of our program draws to an end and we note the successful accomplishment of the original program, that we discuss our plans for continued development with the Joint Committee.

We believe, as you do, it is essential that the Commission's reactor development continue to proceed in an orderly manner toward clear objectives and that the public, as well as industry, is informed of the program plans of the Atomic Energy Commission.

Our accumulated knowledge places us in a position to sharpen our objectives. We can better assess the technological problems which still must be solved. We are able to define with greater assurance the programs, including reactors to be built, special research and development efforts, and administrative arrangements, which will assure attainment of economically competitive nuclear power.

The reevaluation of our objectives and plans has been done with particular awareness of the increasing importance of nuclear power to our friends abroad. We also have given careful consideration to the roles of Government and industry in the conduct of the program.

Program objectives and philosophy: The following objectives are proposed as desirable and feasible:

(*a*) Achieve competitive nuclear power in the United States during the next 10 years: The achievement of economically competitive nuclear power will be attained when utilities can decide to build nuclear plants on the basis of economic evaluation in a normal commercial framework and expect these plants to be as cheap over their lifetime as conventional plants.

(*b*) Achieve competitive nuclear power in friendly foreign nations during the next 5 years through a comprehensive program of assistance clearly defined and vigorously pursued.

(*c*) Fortify the position of leadership of the United States in the eyes of the world in the peaceful applications of atomic energy, particularly with regard to power.

Representative HOLIFIELD. In regard to (*a*) and (*b*), do you believe that the time scales which you have set forth there are realistic on these objectives?

Mr. VANCE. You mean 10 years in the domestic field and 5 in the foreign field?

Representative HOLIFIELD. Yes, sir.

Mr. VANCE. I think that they are, Mr. Chairman.

Perhaps in the domestic field, to expect to achieve competitive power within 10 years is on the optimistic side, but I think in setting an objective we should assume the best. In other words, our target should be high, not low.

Representative HOLIFIELD. The Chair certainly agrees that we should set a target and it is important that we set that target. It is also important that it be based from the standpoint of allocating each year of the 10 years with a program, and that it be an objective program.

I am not passing judgment at this time as to whether it is realistic or not.

What is the general economic gap between the economic power here and abroad? I would refer particularly to the European Continent at this time, in terms of mills per kilowatt.

Mr. VANCE. I would think that the best answer I can give to you is that, speaking very generally, the cost of conventional power abroad is nearly double the cost of conventional power in this country. That is dealing in averages, Mr. Chairman.

I know that you are well aware of the fact that in certain areas in the United States we have low-cost power, as for example in the Pacific Northwest. There are other sections of the country, as in New England, for example, where the haul required for conventional fuels produces high-cost power.

Furthermore, the size of the plant has a bearing upon the cost of the energy produced.

Representative HOLIFIELD. How much difference do you accredit the excess power cost in Europe to the fact that their plants are operated at low-load factor and are in many instances smaller plants, and the gap in cost does not really apply to the difference in fuel cost?

We frequently hear that it is the fuel cost that makes this difference, but certain information we have indicates that they operate a combination of small plants which are less efficient than large plants, and also that their load factor goes down to 40 or 50 percent, where in many instances ours goes up from 60 to 90 percent.

Mr. VANCE. In the first place, Mr. Chairman, I suggest that the fact that in the past conventional plants constructed abroad have been smaller in size than plants recently constructed in our country is perhaps not important in this regard for the reason that, so far as I know, all of the nuclear plants that are planned and contemplated will be large in size. That is to say, the future construction abroad will be in large units and not the small units of the past.

Representative HOLIFIELD. What about the load factor?

The custom of the Europeans along this line seems to me to be much less efficient than we have here at home.

Mr. VANCE. I perhaps am not competent to give you a precise answer to your question, but my understanding is that in the estimates

that have been made of the plants to be built in Europe that a load factor approaching the same load factor that is used in estimates here, roughly 80 percent of capacity, is being used.

Representative HOLIFIELD. That is true. I would realize that factor is being utilized in estimations of costs, but the history of utilization on the Continent is much less than 80 percent, and therefore the question does not resolve—and this enters into whether we should use these figures or not—unless we have some definite assurance that load factors which would make the plant sustain its economic kilowatt rate would be utilized.

There is quite a bit of evidence, I think, to show that the European nations do not utilize economically their capital plant investment because of this one great factor, and it is a great factor.

If you can operate a plant at 80 percent instead of 50 percent, you get all the advantage of the distribution lines and capital investment in the original plant and operating personnel and so forth, and thereby you cut your kilowatt costs down quite a bit.

Mr. VANCE. That is correct.

Representative HOLIFIELD. So if we are going to look at this from a realistic standpoint, I think we have to take into consideration the pattern of industrial procedure in Europe when we are contemplating assistance in terms of many hundreds of millions of dollars to these plants.

If we do not take these factors into consideration, we are in effect fooling no one except ourselves, because a plant that might produce, let us say, 9-mill power in the United States—a nuclear plant that might produce it at that cost operated at 80 percent—the same plant exactly in Europe, if operated at 50 percent, might run that cost up to 16 or 17 mills.

Mr. VANCE. That is right.

Representative HOLIFIELD. Could we have a little analysis prepared by the AEC as to the amount of information they have on this point and what assurance they have that the EURATOM is going to operate at heavier loads than is customary on the Continent?

Mr. VANCE. Mr. Davis, can you say anything on the subject at this time?

Mr. DAVIS. I think it is true that the average system load factors in Europe and in England run more like 50 percent as compared with an average of 60 percent in this country. But this does not determine the load factor at which any individual plant will actually be operated. In fact, where you have a higher proportion of hydroelectric power, the tendency is to operate the hydro plants preferentially to the steam plants if fuel costs are high.

If you have a nuclear powerplant where the fuel costs are relatively low as compared with the fuel costs of a conventional plant, then you would expect that the nuclear plant would be operated preferentially and would in fact over its useful life have a relatively high-load factor as compared with that of the system.

Representative HOLIFIELD. Has there been any information furnished the Commission by the EURATOM group in regard to this point of projected load factor?

Mr. DAVIS. It is certainly their intention, as I understand it, Mr. Holifield, to operate these nuclear plants as base load plants. This

is comparable to the situation in England where they are building the CEA reactors and plan, because of their lower fuel costs in relation to the coal-burning plants, to operate these at load factors like 90 percent. They are planning to operate their nuclear plants as the principal base load in the United Kingdom.

Representative HOLIFIELD. Why should they do that if their conventional fuel plants are more economic?

Why should they use the nuclear plants for base-load plant in place of a supplementary source?

Mr. DAVIS. In England what they hope is that they will get lower fuel costs than they can get with their coal-burning stations. The capital costs are higher, but once you have built the plant and spent the money, you tend to operate, when you have a load, the plant which is less expensive to operate. This is the reason that they plan to utilize the nuclear plants in England as base-load plants and are justified in basing their economics on this kind of a load factor.

Representative HOLIFIELD. Isn't it true that the record of load factor in England is heavier than it is on the Continent?

Mr. DAVIS. It may be somewhat. I do not have the exact figures in mind.

Representative HOLIFIELD. If you could furnsh the committee with definite information on these points for our consideration, we would appreciate it.

(The information referred to follows:)

CAPACITY OF GENERATING UNITS AND LOAD FACTORS FOR PUBLIC UTILITY THERMAL GENERATION AND NUCLEAR GENERATION IN EURATOM COUNTRIES

In considering the sizes and load factors of nuclear generating plants which may be suitable for Euratom countries, it may be useful to take into account—

(*a*) the present sizes of European conventional plants and the rapid shift to large sizes for the future; and

(*b*) the load factors applicable to conventional units, and load factors applicable to nuclear units in the light of prospective fuel costs in Euratom countries.

A. Plant sizes

In the past, conventional thermal utility plants in Euratom countries have generally been smaller in size and have operated at somewhat lower load factors than those for large United States utility systems. However, since the Euratom proposals are concerned with plants which are to be installed after 1960, the basic question is what may reasonably be expected for the near future.

Experience to date in the United States and Europe has indicated that, to meet the rapidly increasing requirements for generating capacity, utility systems are shifting rapidly to larger size generating units. Thus, with respect to the United States, the Federal Power Commission has stated:

"The average unit size of the new units installed in 1955 was 110,000 kilowatts, as compared to 30,000 kilowatts in 1946. Over 85 percent of the total capacity in conventional units now under construction is in units of 100,000 kilowatts and larger. As of midyear 1956, there were 39 units in the 200,000- to 335,000-kilowatt size range on order and under construction * * *" (from U. S. Federal Power Commission Annual Report, 1956, p. 32).

Even larger units are anticipated for the United States in the next few years.

In Euratom countries, approximately 80 million kilowatts of total additional thermal capacity will be needed to provide for growth between 1955 and 1975 (for both utilities and nonutilities) as indicated below:

Total net capacity (MWE), all Euratom countries

	1955	1965	1975
Hydro	19,443	30,040	43,230
Blast-furnace gas	1,514	2,130	2,800
Lignite	3,678	7,500	12,000
Other thermal	26,251	52,800	96,500
Total	50,886	92,470	154,530

Source: Derived from data in A Target for Euratom, p. 80.

Individual Euratom countries' requirements for thermal capacity (excluding gas fired and hydro—but covering both utility and nonutility plants) is indicated below:

Country requirements for thermal capacity, net EMW (end of year)

	1955	1965	1975
Germany	15,625	28,360	50,060
France	6,000	13,100	25,600
Italy	2,118	7,000	17,300
Netherlands	3,570	6,000	9,125
Belgium	2,615	4,258	6,508
Total	29,929	58,718	108,533

Source: Derived from data in A Target for Euratom, pp. 92-98; Luxembourg has only hydro and gas, which are omitted from above tabulation.

The sizes of new thermal units installed by utilities in Euratom countries by 1955 are indicated in the summary below, and the sizes of units already ordered and reported for 1959 installation, and presented in more specific detail in table A, attached.

Sizes of new thermal units for Euratom country utilities (exclusive nonutility)

Size of each generating unit	1959 actual			1959 orders reported		
	Number	MKWE	Percent	Number	MKWE	Percent
100 and larger	10	1,084	41	18	2,050	73
40 to 99	18	992	38	9	616	22
39 or smaller	26	547	21	7	145	5
Total	54	2,623	100	36	2,811	100

Source: Derived from data in Survey of Electric Power Equipment, 1957; OEEC, September 1957, pp. 30-32, 38-44.

The above figures indicate that even by 1959 Euratom countries will be using a substantial number of units of 100 megawatts of larger electric net generating capacity. With the large increase in requirements for subsequent years, the interconnected continental system could easily absorb even substantially larger units without difficulty.

By 1959 the separate system of the United Kingdom will be using units of 200,000 megawatts electric capacity, and in succeeding years the United Kingdom expects to shift rapidly toward units of 275,000 megawatts for 1962 and to develop a unit of 550,000 megawatts for 1963. (Source: Central Electricity Authority—Annual Report and Accounts, 1956–57, p. 22.)

In view of the rapid shift to larger size conventional generating units, and the economies which may be gained with nuclear units of larger sizes, it appears reasonable for the Euratom contries to consider nuclear units of larger than 100 megawatts capacity.

From the point of view of the United States, cooperative United States-European effort in developing these large units may be helpful in advancing United States as well as European technology.

B. Load factor

The United States electric utility system load factors have averaged more than 60 percent in recent years.

Load factors for public utility thermal generating plants in Euratom countries for actual 1955 operation and estimated 1961 operation and relevant capacity and production data are presented in table B attached.

A Target for Euratom, page 81, indicates further the expectation that the average overall load factor is expected to rise from 3,720 hours per year in 1960 to 4,015 hours per year in 1967.

Average load factors for a country, or even for all thermal utilities, are not, however, a valid measure of a load factor at which a particular plant will operate during a given period. Thus, as pointed out in the McKinney panel report (pp. 18–21) a large conventional thermanl generating unit in the United States may operate at a base load of 85 percent for the first 7 to 8 years and then at lower percentages in further years which might lead to a 43 percent plant lifetime load factor. The panel states further (p. 21):

"Since nuclear plants are expected to have lower production cost (fuel plus operation and maintenance) than conventional plants, it is expected that in the middle years of their life nuclear plants will be operated at somewhat higher load factors and conventional plants at somewhat lower load factors. * * *"

The cost of coal or oil delivered to electric utility generating plants in Europe is very substantially higher than in the United States. Thus, the report, A Target for Euratom, states on page 71:

"All of the fuel for new coal/oil stations will have to be imported in all 6 countries, so the present delivered price of imported fuel oil of $20 per ton of equivalent coal can be adopted as a representative average (see annex I, par. 11). The price delivered to sites near ports may in some cases be as low as $18 per ton, rising to a maximum of $22 per ton at sites far inland."

Although there has been a subsequent decrease (perhaps temporary) in freight rates, recent information presented in discussions in March 1958 in Euratom countries, indicate that fuel costs under current conditions may range from $15 to $20 or more per ton of hard-coal equivalent for new plants. At these costs, the cost per kilowatt-hour for fuel in new European thermal plants may be relatively close to the 7 or 8.4 mills per kilowatt-hour estimated in A Target for Euratom, page 72.

Because the number of hours of operation of a plant is influenced primarily by its cost of fuel in comparison to other plants which are available, nuclear plants which may have fuel costs substantially below the fuel costs estimated for Euratom country thermal plants may be expected to operate at much higher load factors. Moreover, since costs of conventional fuel in Europe are expected to increase, it is not unreasonable to anticipate that in Euratom countries nuclear plants can operate at 80 percent load factors.

Because nuclear units will only represent a moderate percent of total generating capacity in Euratom countries and will have lower fuel costs than thermal plants for many years, they will presumably be able to achieve a high lifetime load factor.

TABLE A.—*Sizes of new thermal generating units for public utilities in Euratom*

Size of each unit (MWE)	Germany				France				Italy				Belgium				Netherlands			
	1955 actual		1959 orders reported September 1957		1955 actual		1959 orders reported September 1957		1955 actual		1959 orders reported September 1957		1955 actual		1959 orders reported September 1957		1955 actual		1959 orders reported September 195	
	Number	MWE	Number	MWE	Number	MWE	Number	MWE	Number	MWE	Number	MWE	Number	MWE	Number	MWE	Number	MWE	Number	MWE
150	1	150									2	280							1	125
140																				
125					1	117									1	115				
117							8	920												
115			1	110	1	110														
110					1	107									1	100				
107																				
100	6	600	4	400							2	280			2	215			1	125
100, and larger total	7	750	5	510	3	334	8	920			2	138					7	367	3	240
40 to 99	10	575	3	178	1	50	1	60	2	64	2	35	3	76					3	90
10 to 39	14	382	1	12					1	4	1	8								
Less than 10	6	21																		
Total, by countries:																				
1955	37	1,728			4	384			3	68			3	76			7	367		
1959			9	700			9	980			7	461			2	215			7	45

Source: Derived from data in Survey of Electric Power Equipment, 1957; OEEC, September 1957, pp. 30–32, 38–44.

TABLE B.—*Generating capacity, production, and load factor data for public utility thermal generating plants in Euratom countries*[1]

	1955 (actual)			1961 (estimated)		
	Net capacity, Dec. 31, 1955 (MWE)	Production of electrical energy (million kilowatt-hour)	Load factor (percent)	Net capacity, Dec. 31, 1961 (MWE)	Production of electrical energy (million kilowatt-hour)	Load factor (percent)
Germany	8,530	34,179	46	15,850	71,000	51
Belgium	1,689	5,841	39	2,340	8,150	40
Netherlands	2,886	8,118	32	4,070	13,000	36
France (and Saar)	3,433	9,555	32	6,543	18,685	33
Italy	1,759	5,932	38	2,989	10,500	40
Total for Euratom countries	18,297	63,625	40	31,792	121,335	44

[1] Data on capacity and production from The Electricity Supply Industry in Europe, 1954–61; published by the OEEC, January 1957; pt. II, tables 1 and 3. (No public utility thermal generation in Luxembourg.)

Representative HOLIFIELD. Mr. Ramey.

Mr. RAMEY. In your statement of objective on the 5- to 10-year basis on foreign and domestic, those are not on the basis of having economic plants actually in operation in 5 years or 10 years, but that a utility will make a judgment in 5 or 10 years that it can build a plant that will operate economically. It might just be, however, that they might make a wrong judgment and that plant might be more expensive. So would not a more realistic statement of objectives be something to the effect that you will have plants actually producing electricity competitively in cost especially in a development situation such as this.

Mr. VANCE. I think, Mr. Ramey, what you say is correct, and my hope is that we will have some plants actually producing energy which can be used as a yardstick for determining whether we have or have not reached the objective at the end of 10 years in the domestic field.

I would like in that connection to point out the fact that we obviously mislead ourselves if we think in exact terms so far as average costs in the country are concerned.

I can conceive, for instance, of a nuclear plant being competitive in New England where it would not be in the Ohio Valley, let us say, or better, I should say much earlier in New England than in the Ohio Valley.

Chairman DURHAM. On the basis of the statement, Mr. Vance, you would consider if you achieved economic power in 10 years in New England, and did not achieve it in another part of the country, that we had actually made the achievement?

Mr. VANCE. Yes, sir.

Chairman DURHAM. Instead of an overall average?

Mr. VANCE. I do not think, Mr. Durham, that it would be realistic for us to expect that whereas in our country there are different areas with great differences in the cost of conventional power, that we could expect at the same time coincidentally to achieve competitive nuclear power in all of these areas.

It has to come step by step.

Chairman DURHAM. I think it is a pretty clear understanding since we are making that as an objective in the next 10 years.

You are primarily referring then, to begin with, to the high-cost areas?

Mr. VANCE. Yes, sir. I would think, Mr. Durham, for example, that it would be a very long time before nuclear power will be competitive with hydro power in the Columbia River Basin, where conventional power today costs on the order of 2 mills.

Senator GORE. It might not be very long in Maine.

Mr. VANCE. No. In New England, where the average cost is roughly 8 mills, or 4 times that of the Pacific Northwest, obviously we should expect to be competitive a long time earlier.

Representative HOLIFIELD. You may proceed.

Mr. VANCE. The United States has relatively abundant supplies of fossil fuels. However, even in the United States there is a clear need for development of a new source of energy to supplement present sources. Assessment of timing of this depends upon projections of energy requirements, estimates of relative costs, and judgment of the importance of conserving fossil fuels for special uses in the chemical, metallurgical, and propulsion fields.

The urgency of the overall civilian nuclear power development program is dictated primarily by the need for the United States to maintain a position of technological leadership in the nuclear field and the need for providing help to our foreign friends in their efforts to achieve nuclear power in significant quantities as soon as possible. Because of its importance to their basic economics, curtailment of the need for increasing importations of fossil fuels will not brook delay.

The shorter time schedule for the second objective is believed to be feasible because of the higher cost of conventional power abroad.

In order to serve this particular objective adequately we may be required to include projects which otherwise might not be required. On the other hand, experience and results in pursuit of the second objective will be of great benefit in achieving the first objective, which is harder to reach because of the low level of conventional power costs at home.

The combined program for attaining the first two objectives will accomplish the third objective. This world leadership in peaceful applications of atomic energy is important in maintaining and increasing a close relationship with our foreign friends on a base much broader than a purely military one.

Representative HOLIFIELD. The Chair will announce for the benefit of the members who were not here at the opening statement that we have decided that we will ask questions as we go through because the statement is long, so that at any point that the members wish to ask a question, they are at liberty to ask questions.

Senator DWORSHAK. Mr. Chairman, I wanted to ask a few minutes ago a question as to why it was necessary to achieve competitive nuclear power in the United States during the next 10 years, while the objective is to accomplish that purpose within 5 years abroad.

Mr. VANCE. Why the two time periods?

Senator DWORSHAK. Why are we concerned in building nuclear plants abroad and reaching a competitive position, so far as those countries are concerned, in 5 years, with complete disregard that that may be a disadvantage to this country if it desires to reach the same goal?

Mr. VANCE. No, sir. I think the factors which call for these two separate time objectives are these: In the first place, some of our friends abroad, as, for example the Euratom countries, and United Kingdom, Sweden, Japan, are at the present time required to import a substantial percentage of the total fuel needed for the development of power.

Senator DWORSHAK. What business is that of ours?

Mr. VANCE. That is a drain on their financial resources.

Furthermore, it is a hazard, as was demonstrated by the Suez affair a year and a half ago, insofar as some of these countries who are military allies of ours are concerned. We know that their value in helping us to keep the free world free depends just as much upon their economic strength as their military strength.

Senator DWORSHAK. We have sent a lot of coal in the years past under our foreign aid program to France. Have we built France up so that today she is a military asset?

The same thing will probably happen if we encourage the development of nuclear power over there. That is a laudable objective, but I cannot understand why it is the responsibility of the AEC or the United States to accept responsibility for that.

Mr. VANCE. We are accepting responsibility only to the extent of giving reasonable help to these people in their efforts to achieve nuclear power that is competitive as soon as possible.

Chairman DURHAM. We hope to do some business over there, too, do we not?

Mr. VANCE. I know of no plan whereby we are going to build reactors abroad with American funds.

Chairman DURHAM. As a matter of fact, the difference in time for the two objectives does not relate to any discrimination on our part against achieving economic power?

Mr. VANCE. Not at all.

Chairman DURHAM. It just means we can achieve it quicker over there because the costs are high?

Mr. VANCE. That is right.

Chairman DURHAM. That is the real point, I think.

Mr. VANCE. Yes.

Before you came in, Senator, we discussed the fact that conventional power costs on the average are about double in Western Europe of what they are in this country. Obviously, that being true, it is going to be easier and quicker to achieve competitive nuclear power abroad than it is at home, just as in the United States it is going to be easier to achieve competitive power in New England than it is in some low-cost area like the Ohio Valley.

Senator DWORSHAK. I will not belabor the point now. I will reserve the right to ask further questions later on.

Representative VAN ZANDT. On page 4, you say the United States has relatively abundant supplies of fossil fuel. Representing a congressional district in the fields of Pennsylvania, it is difficult for me to understand what you mean when you say, "even in the United States there is a clear need for the development of new sources of energy to supplement present sources."

Do you really think that atomic energy is going to cut into the energy field to the extent that it will displace the use of coal?

Mr. VANCE. No, sir. That is why we use the word "supplement" and not "replace" or "take the place of."

The fact of the matter is, as you well know, Mr. Van Zandt, the demand for power in this country is increasing at the rate of approximately 10 percent a year, which means that it is doubling every 10 years. Some place along the road, the mining of fossil fuels is going to lag as against that very steep curve of demand. It may be a generation away, it may be 50 years away, but the time is going to come when we have got to get energy from all different sources, as today we are getting it not only from coal but from oil and natural gas.

Representative VAN ZANDT. Of course, your statement is debatable. I assume spokesmen for the coal industry will have an opportunity to answer it.

From the standpoint of cost, can you see atomic power stemming from atomic energy actually competing with energy produced by coal?

Mr. VANCE. I do not know, nor does anyone else know.

Representative VAN ZANDT. In other words, we are gambling?

Mr. VANCE. It is a long ways away.

Representative VAN ZANDT. Thank you.

Representative HOLIFIELD. You may proceed.

Senator GORE. You do make the point, as I understand it, that the urgency for development of atomic power stems primarily from the free world rather than from the United States, but you assert that there is the need——

Mr. VANCE. You mean the economic urgency?

Senator GORE. Yes.

Mr. VANCE. That is correct, I think.

Senator GORE. And also political urgency?

Mr. VANCE. Political as well, yes.

Senator GORE. I mean political in the United States, in the security sense.

Mr. VANCE. That is right.

Senator GORE. But you do assert that it is prudent for the United States to maintain leadership in this field and develop a supplementary source of energy for its own uses?

Mr. VANCE. That is right, because one day we will need it.

Senator GORE. And we do not know how soon, and we may need it in some areas of the United States more quickly than we need it in others?

Mr. VANCE. That is correct, sir.

Senator GORE. Thank you, Mr. Chairman.

I am glad to find that the Commission and the junior Senator from Tennessee are in substantial agreement in that regard.

Mr. VANCE. I hope we will continue to be, sir.

Senator GORE. We have arrived at that position somewhat late.

Mr. VANCE. The program in pursuit of the stated objectives must continue to provide for the exploration of a considerable number of reactor concepts for the purposes of determining which one or ones hold the most promise for economic nuclear power and are, at the same time, reliable and safe.

It is also recognized that the program must include the building of a number of experimental reactors, including several generations

of nuclear powerplants of the same type but of successively improved designs.

At that point I would like to make an observation which to me is very significant, and it is this:

In the past 17 years, the cost of conventional power in terms of stable dollars has come down 50 percent. Today it is half of what it was 17 years ago.

Representative VAN ZANDT. Why the reduction?

Mr. VANCE. That is the point I want to make. It has not been due to any revolutionary change in the concept of a conventional steam plant, but rather, it is the result of an accumulation of small detailed improvements resulting from the building of a large number of conventional plants which on a cumulative basis have produced this, I think, remarkable result.

Chairman DURHAM. They are much larger plants than they were 17 years ago.

Mr. VANCE. That is one of the factors. Higher operating temperatures is another factor, and many, many details of improvement of that sort. I think as time goes on and we can see the development of nuclear power in the perspective of some years, not just 1 or 2 years, that we are going to see that same evolution occur.

Chairman DURHAM. Your study on nuclear powerplants shows the same evidence in the same pattern of larger plants bringing low-power costs?

Mr. VANCE. That is right.

Chairman DURHAM. You agree with that; do you?

Mr. VANCE. Yes, sir.

Senator HICKENLOOPER. Mr. Vance, a major portion of this reduction has been in the higher temperatures, in fact.

Mr. VANCE. Higher temperatures has been a big factor.

Senator HICKENLOOPER. And also the metallurgy of turbines that will take the higher temperatures?

Mr. VANCE. That is right.

By the same token, I think our ability to raise temperatures in nuclear plants will be a big factor in reducing the cost of energy.

Senator HICKENLOOPER. We have already done that to a remarkable degree; have we not?

Mr. VANCE. Yes, but not enough.

Senator HICKENLOOPER. I understand.

We have already in many cases doubled the original rated levels of heat, have we not, in reactors?

Mr. VANCE. Yes, but there is still a great potential ahead of us.

Senator HICKENLOOPER. So we can make progress along that line?

Mr. VANCE. That is right.

Representative HOLIFIELD. This is one of the reasons that the committee is interested in the gas-cooled reactor.

Mr. VANCE. That is right.

Representative HOLIFIELD. We look forward to superheating the steam and bringing up the pressure?

Mr. VANCE. I think the principal reason for building the gas-cooled reactor is that it looks as though there is an opportunity to increase the operating temperatures as compared with liquid-cooled.

Representative VAN ZANDT. Commissioner, is it not true that we have not yet reached the ultimate objective as far as increasing the efficiency of using coal in converting water to steam?

Mr. VANCE. I am sure we have not.

Representative VAN ZANDT. Therefore, any improvements that are made will provide still greater competition to atomic power?

Mr. VANCE. That is correct.

I think there is every reason to believe that with all the talent that is applied to conventional powerplants another 17 years is going to again show a remarkable improvement. They are not going to stand still.

Chairman DURHAM. Do you mean in reduced costs?

Mr. VANCE. Yes, reduced costs of energy.

Chairman DURHAM. I think it is pretty evident if you study the pattern this year, the cost of power has been creeping up for the first time in many, many years in some sections of the country.

Mr. VANCE. That is due to the fact that we are dealing with different kinds of dollars than we were, and that means that it takes more dollars for construction and more dollars to transport fuel. Transportation of fuel is one of the big elements in the cost of operating a conventional powerplant.

Representative VAN ZANDT. The operation of the plant is costlier?

Mr. VANCE. Relative to the other two, that is a small item.

Representative VAN ZANDT. We are talking principally about the cost of fuel.

Mr. VANCE. Construction cost and the cost of the fuel are the two big elements.

Chairman DURHAM. Coal costs twice as much in my section now as it did 17 years ago. That is another factor in my section.

Mr. VANCE. That is right.

Senator GORE. Mr. Commissioner, is it not true that apprehensions are not always justified by subsequent events?

I recall when spokesmen for the coal industry vigorously opposed the development of the Tennessee Valley Authority. Its development was going to reduce the consumption of coal, according to apprehensions then expressed. As it turns out, the TVA is the largest single purchaser of coal in the world today.

Is it not entirely within the realm of possibility that with the developing technology in the utilization of fossil fuels and nuclear fuel, a combination of the two may result in the most efficient production of power?

I ask that question in the light of a statement I read from a distinguished Britisher only the night before last, that they were finding just such a possibility developing in Great Britain now.

Mr. VANCE. I would like to answer your question in this way, and I say this largely for the benefit of Mr. Van Zandt:

A year ago I appeared before the Foreign Relations Committee of the House in connection with a small segment of the mutual aid bill.

Senator GORE. Will you excuse me? Let me read your answer. I think I have a coalman calling me on the phone here.

Mr. VANCE. I will give the answer anyway, Mr. Van Zandt, for your benefit.

One of the members of that committee came from a coal district just as you do. He raised this same point. I told him that to my way of thinking, the coal industry was as near a foolproof business as any I know of where the demand for power is increasing at the rate of 10 percent a year. I told him if I owned any stock in a coal company, I would not sell it.

That seemed to be quite a convincing argument to him.

Representative VAN ZANDT. Commissioner, I suggest you visit central Pennsylvania where all of our shaft mines have been closed down. Today 18,000 people are unemployed, and primarily due to the loss of our coal business and its effect on railroads and related industries.

You have my invitation to visit central Pennsylvania so as to talk with the unemployed and get their reactions.

Mr. VANCE. I am sure there is no argument about the fact that nuclear power has had nothing to do with this present unemployment.

Representative VAN ZANDT. That is true.

Mr. VANCE. Thank you, sir.

Senator HICKENLOOPER. Mr. Chairman, I want to ask Commissioner Vance this question.

We are talking about costs of fuel—that is, the cost of fuel for the production of kilowatts—in the Northwest and in the Ohio Valley of about 2 mills. It runs in my mind that the average cost of a delivered kilowatt to the outlet over the United States, big and little users, is about 3½ cents. So if you threw in the cost of fuel and had it for free, you could not reduce the kilowatt cost of electricity at the outlet much at all?

Mr. VANCE. No.

Senator HICKENLOOPER. Maybe 7 percent if fuel did not cost you anything. So when we are talking about atomic fuels and atomic reactors under the present concept and technology, we are actually talking about the convenience and the security of a source of fuel rather than any great economic benefits that ever result under present concepts with the establishment of even the most efficient reactor because, manifestly, even the most efficient reactors could not reduce that cost very much below the conventional costs in this country.

Mr. VANCE. At the present time, one of the big handicaps——

Senator HICKENLOOPER. I am talking about the cost of the delivered kilowatt at the outlet.

Mr. VANCE. So am I.

One of the big penalties of nuclear power today as compared to conventional power is capital costs.

Senator HICKENLOOPER. Yes. In other words, distribution systems, repair people, electricians, and fixtures go into the cost of that delivered kilowatt. Out of a 3 to 3½ cents per kilowatt on the average over the United States at the outlet, 2 to 3 mills is a very small portion of that ultimate cost. The other costs go into things that nuclear power would not affect in any way?

Mr. VANCE. That is right.

Representative HOLIFIELD. You may proceed, Mr. Vance.

Mr. VANCE. The success of the program will depend upon continuing a broad base effort of research and development and providing reasonable assurance that an adequate number of nuclear powerplants will be built and operated during the next 10 years.

The actual selection of experimental or prototype nuclear power-plant projects will be based upon—

(*a*) Having sufficient technology to proceed; and

(*b*) Judgment that the reactor type represented has sufficient economic promise to be capable of meeting the program objectives.

Any financial assistance from the Government for these projects should be rendered in a manner which preserves normal industrial incentives and relationships and should accord equitable treatment for public and private power groups to the fullest extent possible.

Representative HOLIFIELD. Who is going to be the deciding group in this judgment?

I agree with you that the direction of the technology and the judgment as to reactor type has to be exercised.

Who is going to exercise this judgment, and how?

Mr. VANCE. You want a practical answer and not a theoretical?

Representative HOLIFIELD. I want a practical answer under the law that exists at the present time. I take the position that the Atomic Energy Commission is charged with this responsibility.

Mr. VANCE. Will you let me answer in my words your question?

Representative HOLIFIELD. Yes, sir.

Mr. VANCE. First of all, let me say this: I think as a practical matter that if we start research work on a given type of reactor, the people who are carrying on that research work will never voluntarily give it up. They will not at a certain time admit to themselves, to say nothing of admitting to us, that the prospects are dimmer than they were in the beginning.

It is just human nature not to do that. Consequently, I think that somebody else has got to make this judgment as to whether or not this particular concept is as promising as we thought it was going to be or is more promising and deserves greater support. I think that is a responsibility of the Commission.

I think, however, that the Joint Committee has some responsibility in this situation because, as I proceed with this statement, you will see that we are proposing that we come to you for specific authorization for these various proposals, and we will have to justify them to you and you will have to form an independent judgment as to whether our justification is sufficient.

Representative HOLIFIELD. Your judgment, then, will be rendered upon the different types, whether there should be a second or third generation in a particular type, whether a first generation type offers less promise and shall be temporarily abandoned in favor of more favorable ones.

You will make this judgment as a result of consultation with the industry and reactor experts and so forth and bring that to the committee?

Mr. VANCE. That is correct.

Representative HOLIFIELD. We are hoping that there will be this type of energetic responsibility accepted by the Commission, and we hope that a program can be worked out.

Mr. VANCE. I think, Mr. Holifield, that the conferences which the Joint Committee had last November with industry, and which the Commission had in December with industry, were very productive. I think they should be repeated at least once a year.

So far as I am personally concerned, I hope that these conferences will have a further development in that we will have an advisory group to help us in this particular field. In other words, to periodically advise us on the relative promise of one type of reactor as against another, where we should concentrate our effort, where we should relax it.

Chairman DURHAM. That is getting to be more of a regular procedure at the present time. I have called attention to this need from time to time.

Mr. VANCE. I think we ought to formalize it.

Representative HOLIFIELD. You may proceed.

Mr. VANCE. A summary of power reactor projects which are now visualized as desirable during the period fiscal year 1959 through fiscal year 1963, in essentially a minimum effort consistent with the stated objectives is given in the material attached to this statement which we are submitting for the record.

The power reactor projects summarized have been selected without reference to specific arrangements which might be worked out to provide maximum assurance that desirable projects are, in fact, carried out. The time schedules indicated for individual projects do reflect an acceleration of the normal rate of construction of successive developmental plants.

Representative VAN ZANDT. In connection with your statement, where you say in essentially a minimum effort consistent with the stated objectives, this represents, as I understand it, then, the conclusion of the Commission based on all of their knowledge as well as a digest of the knowledge that was passed on to you by your meeting with industry last fall; is that right?

Mr. VANCE. That is correct.

Representative VAN ZANDT. You think that this program, therefore, is a digest of the best thinking in the country?

Mr. VANCE. Yes.

Of course, it represents some compromise, Mr. Van Zandt. I am sure you realize, if you attended any of the meetings which your committee had with industry, that you do not have unanimity of opinion. There are honest differences of opinion between individuals as to what is the best way to proceed. We tried to weigh these differences of opinion and reach what seemed to be a sensible compromise.

It should be recognized that specific projects or desirable projects within the program become less firm as time is extended. Program flexibility is essential in order to permit adjustments based on technological advances. The program must be subject to constant review, just as it has been in the past.

An annual review is conducted in connection with the normal process of authorization and appropriations. The periodic reviews of progress may be expected to reveal areas of effort or new reactor concepts that will have become relatively more promising than they are now regarded. In such cases there will be new emphasis or acceleration in these areas.

Conversely, as knowledge increases, some reactor concepts will reveal a lack of promise.

It is intended that the reviews will be carried out vigorously. Projects that may completely lose their promise will be eliminated, and,

more importantly, the degree of emphasis on those projects carried forward will be adjusted to their relative degree of promise.

I think that is a most important point in our discussion.

Representative HOLIFIELD. I think there should be no hesitancy upon the part of the Commission in this experimental and development field when they have given a certain project or type a trial, if in the best judgment of the Commission and its technical advisers that project should be abandoned or eliminated for the time being, in doing that. I think it would be worse than extravagant to carry on something just because a commitment had been made or a selection had been made in this field.

Mr. VANCE. We cannot indefinitely postpone the selection of some of these reactor types as being more promising than others.

Representative VAN ZANDT. Several will have to be selected and started in order to find out if they are feasible and promising?

Mr. VANCE. That is right.

Chairman DURHAM. You have to eventually get something in the warehouse?

Mr. VANCE. That is right.

Representative HOLIFIELD. The dropping of the Arbor project might be considered an example in this field?

Mr. VANCE. One outstanding example is that the Navy went ahead with the pressurized water reactor for submarines along with the sodium reactor and, after relatively little comparative experience, dropped one in favor of the other.

Chairman DURHAM. That brings up a very interesting question. With this program being carried on in the services and growing all the time, do you mean to intend this to cover the Navy, the Army, and the Air Force as a projected program?

What control will we have, in other words, if the Navy wants to go on with a research project forever?

I think it is important to clarify this thing and let the services understand that we are going to continue to improve these reactors in whatever field. I think we ought to cover the whole field.

Mr. VANCE. I do, too.

Chairman DURHAM. I may be wrong.

Mr. VANCE. I think our discussion so far has been directed primarily to the civilian reactor program.

Chairman DURHAM. That is true, but you cannot get away from the other.

Mr. VANCE. The two have been inseparable.

Chairman DURHAM. They have been useful?

Mr. VANCE. We are going to get, as we have in the past, a great deal of information of value to our civilian program.

Chairman DURHAM. We have already done that.

Mr. VANCE. Look at the *Nautilus*, for example, and the prototype of the *Nautilus*, which was the basis for Shippingport, and the whole technology for the pressurized water concept.

By the same token, I am sure that the military will benefit by what we accomplish in the civilian reactor field.

Chairman DURHAM. Then, would you state as your objective that you feel that the Commission, as Mr. Holifield has brought out here, does have the right and the control at some point in this basic re-

search field where you decide that a propulsion system is not feasible and you say "No," and that would end it?

Mr. VANCE. I think I might say we would say "No," but I cannot say that would necessarily end it.

Chairman DURHAM. Whether or not it would prevail is another question. Of course, the President could decide it.

Mr. VANCE. Yes, that is right.

I think perhaps in the military field, it has to be a joint determination.

Chairman DURHAM. I would say this: I think your objectives ought to be pretty clearly defined between the AEC and the services of the country because we will waste too much money otherwise.

Mr. VANCE. Yes.

I might say that when we talk about military reactors, the objectives are usually different than when we talk about civilian reactors.

For example, take the *Nautilus*, which has been a tremendous success. The objective of the Navy in the *Nautilus* was not low-cost power. The objective was extraordinary operational ability, and that was achieved.

Representative VAN ZANDT. Also unlimited cruising ability.

Mr. VANCE. Although a high price was paid for it, it was well worth the price.

Chairman DURHAM. Yes, but it could not run except for the basic research that was done on the fuel elements primarily by your Commission.

Mr. VANCE. That is right.

Representative VAN ZANDT. What degree of unanimity, as far as the Commission is concerned, prevailed when the program you are discussing was cleared for presentation this morning?

Mr. VANCE. Two of the Commissioners are here with me this morning. They can express their own views on that matter.

In further answer to your question I believe that this represents the unanimous views of the Comission.

Mr. GRAHAM. Are you addressing yourself, Mr. Van Zandt, to this very important paragraph that Mr. Vance has just talked about, of winnowing out projects that no longer prevail?

Representative VAN ZANDT. I am talking about the overall program being conveyed to us this morning through the statement of Commissioner Vance.

Let us say the overall objective.

Mr. GRAHAM. Speaking for myself, and I think this is probably true in any situation where you have different people with different background, training, and experience, all of us have different ideas. We may agree on a particular program or a particular point sometimes for entirely different reasons.

As far as this statement is concerned, I am not here to object to it or dissent from it. I think it is a fair summary of our various views.

As Mr. Vance has indicated, whether you are going to get to your objectives in 10 years or not is something that nobody can really answer. But what you are talking about is at least some goal; you set your sights, hopeful you can achieve it. Maybe not. But at least, for purposes of planning, it does not seem to me that it is unrealistic. I have tried to answer you generally.

Representative VAN ZANDT. In other words, what you are saying is that this is the best program that can be spelled out at this time?

Mr. GRAHAM. As Mr. Vance has indicated, various views were expressed by reactor experts we had there, I am sure this is true in this committee. This is the nature of the process, what we are pleased to call the democratic process, trying to come out with the best that you can as the conditions that you have to face at that time.

I am not attempting to speak for my colleague, Mr. Floberg. If I have answered your question, I will stop there.

Representative VAN ZANDT. You have, sir.

Mr. FLOBERG. I would say that this piece of paper represents a consensus of our views, Mr. Van Zandt. There might be any number of points in here that any one or the other might say, "I only subscribe to 50 percent to that particular point" or other points that we might feel overenthusiastic about.

This is a fair consensus of our views. No one of us might have written this particular piece of paper. Any one of the five might have written it differently if he were writing it. This is a consensus on which we can join.

Representative HOLIFIELD. The Chair notes the absence of the Chairman, Mr. Strauss, and also Dr. Libby. When you say this is a consensus of your views, are you authorized to present these views as being also their views on the subject?

Mr. VANCE. I think I can say that the Chairman, Mr. Strauss, is not in disagreement because he said yesterday that he had read this memorandum and had no criticism of it, except he thought it was too long.

Dr. Libby has been ill and we have not had an opportunity to consult him.

Senator GORE. Too long on reactors?

Mr. VANCE. Beg pardon?

Senator GORE. Too long on reactors?

Mr. VANCE. Too many pages.

Representative HOLIFIELD. You may proceed.

Mr. VANCE. A statement of long-term policy and objectives of the Government on nuclear power development is desirable, if not essential, in order to improve stability and facilitate planning by the industry. The desirability of facilitating planning and maintaining a certain minimum momentum in the nuclear power industry is not to be taken as an intent to support all who are in the field or who may want to get into the field.

The program thus far has proceeded on a broad front of technological development and industrial opportunity. The development is expected to continue on a broad front, at least for the present, and there will continue to be industrial opportunity.

It is important that competition be preserved, but the program objectives must be achieved by establishing a sound technical and economic basis for a nuclear power industry, not by artificial and premature expansion of the industry.

It should be recognized that achievement of the stated objectives does not imply cessation of further development. The objectives are limited ones in that they seek achievement of nuclear power in some areas of the United States and in some areas of other countries in the time considered.

Program implementation: The Government's overall civilian power reactor development program is visualized as consisting of three major parts. These parts are:

(1) The base program of research and development aimed at advancing the frontiers of nuclear technology and exploring a broad base of different reactor types;

(2) Domestic cooperative projects; and,

(3) Assistance to projects in other countries.

It is convenient to discuss implementation of the proposed program in accordance with these major parts.

Base program: The Atomic Energy Commission will continue to support a broad base of technological development directed toward advanced types of nuclear powerplants for lower cost and a wider range of applications in the long run.

An expanded program for the development and improvement of the fuel cycle will be established to be responsive to the needs of power reactors generally. This effort will have as its objective increased efficiency and lower costs not only for the whole family of pressurized and boiling water nuclear power installations, but also fuel cycles applicable to high temperature power reactors utilizing liquid metals and gas coolants, including nuclear superheat of steam.

This program will embrace materials and process development, as well as design, fabrication, and chemical preprocessing of fuel elements in single prototypes and large batches. The work will include use of both uranium and thorium source materials and all fissionable materials—that is, plutonium, uranium-235, and uranium-233. It is the intent that general fuel cycle development will be about doubled over the recent level of effort.

Mr. RAMEY. How does that line up in terms of money?

We have a statement submitted by Mr. Davis on the general 1959 operating budget that is broken down somewhat on the civilian program. Perhaps it might be desirable to introduce this into the record at this stage.

Mr. VANCE. Do you want to discuss that now or later as we get into the detail of the authorization?

Representative HOLIFIELD. We will discuss this later, but I think it might be placed in the record at this time if there is no objection, because it does put down in specific programs an estimate of the amount of money that would be involved and the types of reactors and the supporting program. I think it would add meaning to this session if it was inserted at this point.

(The material referred to follows:)

Reactor development program—Fiscal year 1959 budget

[In millions]

	Fiscal year 1958	Fiscal year 1959		
		Base program	Supplemental program	Total
Civilian program:				
Civilian power	$74.5	$83.1	+$7.8	$90.9
Supporting program [1]	34.2	28.4	+15.0	43.4
Commercial ship	2.1	3.7	+0.7	4.4
Subtotal	110.8	115.2	+23.5	138.7
Military program:				
Army package reactor program	5.8	5.6	+3.0	8.6
Naval propulsion reactor program	88.7	87.0	+4.4	91.4
Aircraft propulsion reactor	78.0	86.0	+14.0	100.0
Subtotal	172.5	178.6	+21.4	200.0
Controlled thermonuclear program	20.0	25.5	+13.6	39.1
Equipment	17.8	17.1	+2.7	19.8
Total	321.1	336.4	61.2	397.6
Cooperative arrangements	8.2	14.6	+8.1	22.7
Total	329.3	351.0	[2] +69.3	420.3

[1] These have application not only to the civilian power program but also to the military reactor program.
[2] In addition to this amount, in the operating expense appropriation (increase in goods and services on order account), there is included $27.5 million to enter into contracts for space in power and test reactors.

(The following table is a detailed breakdown of the civilian program:)

[In millions]

Operating cost	Fiscal year 1958	Fiscal year 1959		
		Base program	Supplemental program	Total
Civilian power reactor program:				
Pressurized water reactor	$17.6	$20.4	0	$20.4
Boiling water reactor	4.0	5.5	0	5.5
Homogeneous reactor	14.6	16.5	−$2.2	14.3
Fast power breeder reactor	8.6	14.1	−1.7	12.4
Sodium graphite reactor	7.5	7.0	+1.8	8.8
Liquid metal fuel reactor	6.7	7.9	+.1	8.0
Organic moderator reactor	5.3	2.2	+1.3	3.5
Plutonium recycle reactor	3.6	4.0	+1.0	5.0
Pressurized heavy water reactor	1.9	4.0	+1.5	5.5
Gas-cooled reactor	3.8	0	+6.0	6.0
Advanced design studies	.9	1.5	0	1.5
Subtotal, civilian power	74.5	83.1	+7.8	90.9
Supporting program: [1]				
Reactors systems research and development	11.1	10.0	0	10.0
Applied fuel cycle program	0	0	+13.0	13.0
Reactor safety	8.6	7.6	0	7.6
Separations systems development	10.5	9.0	+2.0	11.0
Operational services	4.0	1.8	0	1.8
Subtotal	34.2	28.4	+15.0	43.4
Commercial ship program:				
Pressurized water reactor	.4	1.9	−.2	1.7
Maritime gas-cooled reactor	.8	1.8	+.9	1.7
Development of health, safety, and operating rules and regulations	.2			.3
Advanced reactor studies	.7			.7
Subtotal	2.1	3.7	+.7	4.4
Total	110.8	115.2	+23.5	138.7

[1] These programs have application not only to the civilian power reactor program but also to the military reactor program.

Mr. VANCE. I am not familiar with the statement.

Are test reactors included in it, Mr. Ramey?

Mr. RAMEY. I think money for contract obligations, possibly.

Mr. VANCE. I think it should be in the picture because it is an essential part of this intensification of the development of fuel elements.

Representative HOLIFIELD. This was forwarded by Mr. Davis on June 2, 1958. So it is a current estimate.

You may proceed.

Mr. VANCE. In order for such a program of fuel cycle development to be successful, it must be accompanied by provision of adequate facilities for irradiation and post irradiation examination of fuel elements.

The Commission should be authorized to make contracts to take time in facilities built by private industry.

At that point, I would like to add to the text by saying that we have discussed on several occasions the fact that test reactors operated by private industry have the disadvantage that other industries might be reluctant to put some of their experimental work into a competitor's test unit. This text should read "private industry and universities and research and nonprofit research institutions."

For example, there is the Batelle Institute at Columbus, Ohio. I am sure private industry would be perfectly willing to utilize organizations of that sort, whereas they might be reluctant to use a competitor's test reactor.

Chairman DURHAM. I certainly would hope that this would allay the the fear because there has been some fear in this regard.

Mr. VANCE. That is correct.

Chairman DURHAM. Would that time be obtained on the basis of economic justification rather than on the basis of just subsidizing a private test reactor?

Mr. VANCE. I think the form, Mr. Holifield, would be this: If an organization like Case Institute of Technology, who made a study of this subject, were going to raise the money to build a test reactor, they would have to have some reasonable assurance that there would be income in order to raise the money or to borrow the money to build a plant. In other words, that the facilities would be used up to the point where the obligation could be paid off.

Representative HOLIFIELD. Would it be the intent of the Commission to have their own work done there or to contract for the use of the test reactor and then lease out time?

Mr. VANCE. I think it would be a combination of the two. It would be both. It would come into operation only if industry did not take up that minimum time. It would be in the form of a guaranty, let us say.

Chairman DURHAM. Let us take a practical example.

If you had a contract, for instance, with X company and he desired some work to be done with regard to some metallurgical testing, and you had to contract with him, you could use that space in the other private reactor.

Mr. VANCE. That is right.

Representative HOLIFIELD. Does this come about because the Commission asked for $35 million for materials and engineering test reactors and the Bureau of the Budget denied it?

Did this suggestion come about as a result of that determination?

Mr. VANCE. I do not know whether they denied the whole item or not.

Representative HOLIFIELD. Our records show that they did.

Mr. MCCARTHY. The situation was that this proposal was reviewed again in the light of previous Commission policy, and it was determined that the money should be available for contracting for space in test reactors.

Mr. VANCE. That is presently in our budget.

Mr. MCCARTHY. Yes, sir. There is $27,500,000 in total. That includes the fuel cycle.

There are two phases to it. One is for the rental of space in test reactors, the other is in connection with rental of space in power reactors. There is $27,500,000 in total for the reactor space.

Representative HOLIFIELD. So what the Budget Bureau has allowed you to do is to put in an item to pay out in rental of $27,500,000 instead of the $35 million which you asked for materials and test reactors?

Mr. MCCARTHY. That is correct, sir.

Representative HOLIFIELD. That is why I was asking you the first question: Would this time be purchased on a base which would be economic to the Government in comparison to what it would have cost the Government to have constructed its own reactors, or is there in this element of rental a subsidization and amortization of private industry's reactors?

Mr. VANCE. I think the answer to your question, Mr. Holifield, is this: So far as I know, no nonprofit institution like Batelle or Case has contemplated charges for the use of the reactor time in excess of actual estimated cost. In other words, the objective has not been to make a profit.

Representative HOLIFIELD. The rentals would be spent in the main with universities and nonprofit institutions rather than with private profit enterprises?

Mr. VANCE. That is correct.

Representative HOLIFIELD. Is there any indication that these reactors will be built by these institutions so that they will be available for you to participate under contractual arrangements?

Mr. VANCE. We are led to believe that they will be built.

I might say, in our original requests we asked for the authority to use the money alternatively. In other words, to support reactors if they were built by nongovernmental institutions, and if we did not get the proposals from them, that the money be available for use to construct additional test reactors.

Representative HOLIFIELD. Yes, but that has been denied, as I understand it, and now you do not have the alternative right.

Mr. MCCARTHY. No request for authorization of construction was sent to this committee. But there is a Commission policy of some standing which provides, and the Commission has served notice to industry, that we would in effect buy space in test reactors. It is on this basis, and on the indication that some test reactors would be built, that this money was put in the operating budget for the purpose of paying for rental of space including obligating for amortization of the reactor.

Representative HOLIFIELD. How many proposals does this Commission have in this field?

Mr. VANCE. I think Mr. Davis probably could give you a better answer.

Representative HOLIFIELD. Are there any?

Mr. DAVIS. There is the one in South Carolina. The J. A. Jones organization plans to build a test reactor.

Chairman DURHAM. That one is in North Carolina?

Mr. DAVIS. I beg your pardon. Of course, Case Institute and quite a number of other people are interested. There was a group of Lockheed, Philips—I can't recall all four companies who were studying this. There are quite a number of indications that there will be test reactors built. If we can contract for a part of the space in these reactors this will be very helpful. We will need the space.

As you know, Westinghouse and GE are building test reactors of their own as well. It is our thought to purchase space on a contract basis where we would use at least a certain amount of it, and to carry out the various fuel element tests and irradiations that go with the fuel cycle program in the space as is necessary.

Representative HOLIFIELD. I think that the summary of the seminar with reactor experts on November 21, 1957, point 8, should be read into the record at this time. Their recommendation was that additional research and testing reactors similar to MTR and ETR need to be built by the Government.

We cannot depend entirely on private industry to build and support research and test facilities. This includes hot cells and supporting equipment.

Industry often has excess capacity in its own facilities, but competitive considerations have a tendency in some instances to discourage the use of one firm's facilities by another.

Mr. VANCE. That would apply only to those owned by industry.

Representative HOLIFIELD. That is right. That would not apply to universities and nonprofit institutions, such as Batelle.

However, as to the first part of it, that there was an indication that probably these institutions would not build these reactors and they would have to be built by the Government, time alone will tell whether they will or not.

How many universities have shown an interest in this? Can you tell us, Mr. Davis?

Mr. DAVIS. I am sorry I cannot give you the exact number offhand. I do not think there have been a large number of universities.

The principal example that occurs to me at the moment is the Case Institute, who have been interested. The others that have talked about what are really testing reactors have been primarily these various industrial groups who had hoped to set up reactors in such a way that they would be utilized generally by industry and would not have the kinds of restrictions that some of them have worried about.

Even these that are being built by Westinghouse and GE would be of use to us if we are carrying out part of the fuel cycle program with them. I would expect that we would make pretty broad use of all of the test reactors which are likely to come into existence.

I would like further to add that our studies of the necessity for space in test reactors has shown that there is now and will be for quite a period in the future quite a demand for space. The problem is that companies who are interested in building these reactors, although they can see the demand, cannot get anybody to sign up and say they are willing to contract now for it.

Representative HOLIFIELD. What would happen to a test, let us say, of a fuel element that was contracted by the Government to a private enterprise group? I am not speaking about the nonprofit group; I am talking now about some that are in existence at the present time owned by industry.

Would the Government personnel conduct that test and the results of it be made available to all of industry, or would the people that own the facility acquire an advantage through having a test made in their particular testing reactor?

Mr. DAVIS. Any tests that were conducted as a part of the Commission's fuel cycle program or as part of any of the specific reactor projects would, of course, be the property of everyone and disseminated to everyone. The people owning the particular test reactor in which it is carried out would have no advantage over anyone else.

Representative HOLIFIELD. So the point of competitive fear which apparently exists between one private industry utilizing another private industry's test reactor would not obtain in the event of the Government contracting for time in those reactors?

Mr. VANCE. They might still be somewhat reluctant, but I do not think they would have the same fears. I think their reservations were expressed with respect to their own private work.

Representative HOLIFIELD. I can visualize that one private company developing a reactor with their own funds would not want to buy space in their competitor's test reactor.

Mr. VANCE. I suggest, Mr. Holifield, the real test is whether the Government is financially supporting or not. Some of these companies are doing experimental work of their own without Government support. In that field, the results belong to them. But if it is supported by the Government, it is in the public domain.

Chairman DURHAM. What is the length of time at the present time, with the authority you have already, for making such contracts, Dr. Davis?

Mr. DAVIS. I am sorry.

Chairman DURHAM. There has been some fear about the length of time on the long-term or short-term contracting for space.

Due to a ruling some years ago, the Commission did not feel you had the authority to contract for this space.

Mr. DAVIS. I am not really qualified to talk on the legal aspects, Mr. Durham, but I know we wanted to get this clarified so we would have a clear authority to enter into contracts for a period of some years to take a part of the space in the test reactors so there would be no question about this point. I think if you want to discuss the legal details, I would have to refer to the General Counsel.

Chairman DURHAM. I will not bring it up at this time, but I do think it is important. People are not going to build these reactors unless they have some assurance that they are going to get over a 60-day contract.

Mr. VANCE. That is right.

Chairman DURHAM. You do not do basic research on that basis.

Mr. OLSON. Mr. Durham, legislation is in process now and is presently before the Bureau of the Budget. We should have something here very shortly.

Chairman DURHAM. You are going to ask for it?

Mr. OLSON. Yes, sir.

Representative HOLIFIELD. What year term are you going to ask for?

Mr. OLSON. Five years on materials and a maximum of 10 years on test reactors, because you count the period of construction. Five years plus the period of construction, but not to exceed 10 years.

Representative VAN ZANDT. I have been led to believe that there is a shortage in space from the Commission standpoint as far as test reactors are concerned.

Mr. VANCE. That is right.

Representative VAN ZANDT. Why is it that the Curtiss-Wright Corp. reactor in Pennsylvania has practically nothing to do at the present time.

I can understand why competitors are not using the reactor, but I cannot understand why the AEC does not rent the surplus space.

Mr. VANCE. I cannot answer your question because I did not know it was a fact.

Mr. DAVIS. Mr. Van Zandt, there is quite a difference in the types of reactors that we are talking about here. Actually, there is really no shortage of space in the low flux kinds of facilities, the small reactors of 1 or 2 thermal megawatts. Even in the MTR there is a great deal of space of this sort which is not used. The real demand in the kinds of reactors we are talking about here are reactors which might be from 10 thermal megawatts up to as much as 100 megawatts, where you cannot only have a high flux and a high power, but also put in appreciable size loops and things of this sort and actually test fuel elements. This is really quite a different situation and I think it does explain why there is no great demand for the low intensity type of space.

One other point is that I think that people who use low intensity type of research reactors normally are conducting the research adjacent to the reactor. In this case there is a very real incentive to to have the reactor at the laboratory that is doing the research work, whereas in the case of test reactors, people are willing to ship large experiments that are going to run for a long time to places like Idaho. Some of these tests require months, and if you get into long-lived elements they may require years.

You are talking about a quite different situation.

Representative VAN ZANDT. Thank you.

Representative HOLIFIELD. Would it be fair to say that this is a critical field, that is, this field of having available plenty of test reactors at this stage in the development of the art, and also these reactors being made available by these nonprofit institutions so that there will not be a bottleneck in testing?

Mr. VANCE. I might say in that connection, Mr. Holifield, that in the three industry meetings which we had last December, as I stated previously in this session, there were great differences of opinion as to what kind of program we should have and the form it should take. There were one or two things on which there was unanimous agreement on and one was that we needed more test facilities.

Representative HOLIFIELD. The committee will understand that it will be kept informed as to the progress in this field. We would like to have something a little more definite in the way of memorandum showing the interest taken in the field of building these reactors, and

how many people you are dealing with, and whether these are firm plans or not.

If we are going to sit still here and depend upon an intangible arrangement which is not materializing, this would be a field, I am sure, that the committee would want to take some definite action in. I would rather personally see that engineering test reactors are built than some other projects which have been suggested. I would rather see that done in case that it is not going to be done by these nonprofit institutions.

Mr. VANCE. My own opinion is that we probably will wind up by doing it both ways.

In other words, we will get some interest from industry, from nonprofit institutions, and we may have to build 1 or 2 Government-operated test reactors.

Representative HOLIFIELD. If you have to build, it would depend upon a future authorization and appropriation?

Mr. VANCE. That is right.

Representative HOLIFIELD. And not 1959, and we would lose another year?

Mr. VANCE. That is right.

Representative HOLIFIELD. You may proceed.

Mr. VANCE. This contract authority for future service would stimulate the building of necessary facilities by industry.

Where I use the word "industry," we include nonprofit organizations and universities.

Maximum use also should be made of large-scale prototype power reactors for irradiation of multi-ton lots of developmental fuel elements.

Domestic cooperative projects: The Commission, as a general rule, will undertake the research and development necessary for preliminary evaluation of promising reactor concepts and the necessary reactor experiments and related development for such concepts. Such work generally will be done in the National Laboratories or by industrial contractors to the Commission with Government funds.

The Commission visualizes that the next step in size and development beyond the reactor experiment is a developmental reactor which would be essentially an experimental prototype reactor if built under Commission responsibility or a developmental prototype if built under industrial responsibility.

The Commission will undertake to assure that experimental reactors of larger and appropriate size are built as the next stage beyond the reactor experiment, particularly for those new types involving new and undemonstrated principles.

It is believed that industrial participation in such projects is desirable and that it can be obtained in most cases if sufficient flexibility is provided. In some cases industry may wish to undertake even fairly experimental projects with or without some assistance from the Commission. Such cooperative arrangements on highly experimental projects should not be precluded, though it may not be the usual case, at least during the early years of the program.

Representative HOLIFIELD. You have put out a program here. I would like to ask you if the financial level of support requested for fiscal 1959 and the projected estimates of projects through fiscal 1963

is sufficient in the 1959 budget to carry out this program, or is a great deal of this an intangible program which you are proposing here, which in the last analysis depends upon the willingness of industry to put up the money?

Mr. VANCE. I think your question is a general one. I will have to answer in general terms.

I think that the important parts of the program that we are proposing are covered by our requests to you for authorization and for operating funds.

Chairman DURHAM. In 1959?

Mr. VANCE. Yes; that was the question, as I understand it.

Chairman DURHAM. Of course, it involves future authorization of funds if you carry out the 5- and 10-year programs.

Mr. VANCE. That is correct.

Representative HOLIFIELD. You had quite a few things cut out by the Budget Bureau that you requested. There is $150 million worth of projects that were cut out by the Bureau of the Budget in the field of propulsion plants, tanker propulsion plant, heavy water power reactor; 65 million, Department of Defense small plant reactors; 30 million, metals process development; $1,900,000, metals and ceramics research building at Oak Ridge; $6,500,000 and the ARBOR of 5 million, which I understand was withdrawn.

So you have close to $150 million worth of projects which could rightfully be enveloped by this statement on page 10 here that has been denied to you by the Budget Bureau.

To that extent, I suppose, we would have to take this with a grain of salt and adjust our thinking in regard to its meaning.

Mr. VANCE. I think, Mr. Holifield, that we have to discuss these things item by item. I do not think any generalization is going to bring out the information that you want.

Furthermore, I might say that some of these items included in the $150 million that you speak of, if they are not included in the 1959 budget, probably will be in the 1960 budget, and some of them perhaps can be included in the 1960 budget without slowing up the program.

Representative HOLIFIELD. You may proceed.

Chairman DURHAM. You did use a priority system in trying to arrive at the items?

Mr. VANCE. Yes; that is correct.

Representative HOLIFIELD. You did not use the priority system. The Budget Bureau set the priorities.

Mr. VANCE. Yes.

Representative HOLIFIELD. You asked for all of these as a matter of a program?

Mr. VANCE. But we got some of these items back, Mr. Holifield.

Representative HOLIFIELD. You have got some back?

Mr. VANCE. Yes, sir.

Representative HOLIFIELD. Which ones?

Mr. VANCE. I do not know which ones you are referring to, but what I mean with regard to the items which the Bureau of the Budget questioned in the first instance, some of them were restored, and that I think is what Mr. Durham referred to. The restored items were the ones that we considered to be the more important.

Representative HOLIFIELD. This is as of May 13. I do not think you have had any of these items I have read restored. You might check it and see. I think this was your final cut, as we have it in our records.

You may proceed, Mr. Vance.

Mr. VANCE. It is expected that later generations of the various power reactor concepts, including prototype or commercial projects, will generally be undertaken by industry with or without assistance from the Commission. In this work industry can be expected to engage in substantial programs of research and development, including component improvement and testing, materials development, and design studies, in order to have a firm basis for their work. Research and development of this nature seems most appropriate as a basis for cooperative arrangements between the Commission and industry.

It is visualized that construction of developmental or experimental prototype nuclear powerplants will be initiated on schedules consistent with technical feasibility. The number and type of projects initiated each year will be dependent upon the status of pertinent technology. It is expected that several projects will be initiated some years while none may be initiated in other years.

It is recognized that ultimate success of the program must lead to strictly commercial plants which are justifiable without financial assistance from the Government.

The size of the power reactors built should be sufficient to prove out the technology and to provide a sound step in the progress toward economically competitive nuclear power. The selection of size should represent a balance between reducing cost and gaining technology for the particular reactor type at its particular state of development.

Some of the power reactors built will be prototypes for low capacity nuclear powerplants, under 50,000 EKW; however, it is to be expected that commercial plants in the low capacity range, in general, will derive from the prototypes of large capacity nuclear power plants and from the construction of several small nuclear powerplants at military bases overseas which is proposed in cooperation with the Department of Defense. Some of the nuclear powerplants initiated are expected to be capable of generating several hundreds of thousands of electrical kilowatts.

The framework for cooperating with industry in the building of developmental prototype nuclear powerplants is visualized as consisting of two parts.

The first of these parts may be described as an expression of the willingness of the Commission to consider proposals from industry requesting research and development assistance in order to proceed with nuclear powerplant projects which appear to have real promise. This policy is, in fact, an extension of the power demonstration reactor program.

Provisions of this program given in the Commission's announcement of January 7, 1957, and in Public Law 85–162, limit the date for approving proposals to no later than December 31, 1958, and expect completion of plants by June 30, 1962. These dates need to be extended in order to have an active program during the coming year.

Therefore, it is proposed that the date for approval of proposals be extended to December 31, 1959, which is 12 months, and the date

for completion of plants be extended to June 30, 1964, which is 24 months, in order that the anticipated completion dates may be realistic.

It is also proposed that the ground rules of the third invitation for nuclear powerplant proposals under the power demonstration reactor program be modified to indicate that the Commission will consider requests for use of hevay water without charge for the contract preiod, without regard to the ability of the reactor to operate on natural uranium fuel.

The Commission will accept only projects for the construction of reactors which are based on relatively well-developed technology under this program. The second part of the framework for cooperating with industry applies particularly to developmental reactors or first generation reactors.

Representative HOLIFIELD. Before we go into the second part, we have a few questions that should be asked at this time.

Mr. Ramey.

Mr. RAMEY. Has not the type of project submitted in the power demonstration program changed somewhat in the last year?

For example, the Pennsylvania Power project is more of a research and development effort in its phase one aspects with no obligation to construct.

Mr. VANCE. That is correct.

Mr. RAMEY. The Carolinas has an obligation to construct, but is a relatively small plant. In other words, it seems to be becoming more of a research and development effort of smaller scale projects.

That raises the further question whether or not the program might be redirected a little bit further along the lines you indicated earlier to support second generation and successive generation plants, rather than more developmental efforts, which seems to be the current crop you are getting.

Mr. VANCE. It is my own personal opinion that this change which you described, and which I think you described correctly, is a change for the better. I think it is a recognition of the fact that perhaps in this manner we are going to make quicker progress than we otherwise would make.

Mr. RAMEY. In our hearings on the Pennsylvania project, it was not so much of an indication that we are making quicker progress, but that a company that has gone into this project saying it was going to use its own money, found itself in trouble, and required more governmental support.

Mr. VANCE. That is true. It is suggested that the reason for the governmental support was that the project still appeared to be promising, and therefore should not be abandoned.

Mr. RAMEY. On the other hand, there is no assurance that there will be any actual prototype plant constructed?

Mr. VANCE. No. My understanding is that this project has been separated into two phases and that the Joint Committee has under consideration now only phase No. 1, which is strictly research and development.

Mr. RAMEY. Is it the Commission's view as a whole that it is desirable that we encourage private industry to undertake these more risky first generation prototypes?

Mr. VANCE. I do not like to generalize on a proposition of that kind, Mr. Ramey. I think there are some situations where the answer would be "Yes" and some where it would be "No." I might illustrate my reason for giving you that kind of an answer. You are familiar with the Wolverine project, which we have abandoned. That was for a homogenous type of reactor. That was a situation where a small cooperative would be taking a kind of risk which I do not think a cooperative should take. It is quite a different matter when a large utility comes in and proposes a similar program.

Representative HOLIFIELD. Of course, the position that you take today is completely different from what was taken a year ago on the Wolverine project. They defended that to the bitter end. A lot of us had some doubts as to that type of a project being saddled on a small cooperative. Personally, I was glad to see that it was abandoned. You are getting into a field here where you are going more and more into research and development and less and less into the building of reactors.

Mr. VANCE. Less and less in the building of large reactors.

Representative HOLIFIELD. That is true.

Second and third generations some of which seem to indicate that they should be started within the time period of the next year or two.

If we are going to be faced with a continued refusal on the part of industry to build these second and third generation reactors, then we are going to lag behind in the accomplishment of some large reactors, just as we have been lagging.

Mr. VANCE. I think that depends entirely on what progress we make, let us say, in the next 12 months in research and development.

Representative HOLIFIELD. Have you received any formal or informal proposals for a fourth round to be set up which would actually involve liberalizing the third round provisions and bringing more Government subsidy into the program?

Mr. DAVIS. I do not believe we have received any formal proposals. We have had a few discussions, I guess, which might involve various types of assistance but nothing that I would call a real proposal.

There is some interest in the field of process heat reactors and whether the program might not be extended to include those, for example. But this does not provide for a different form of assistance, but merely extending it to reactors that produce steam instead of power.

Representative HOLIFIELD. Has here been any proposal to qualify under the existing third round criteria of assistance?

Mr. DAVIS. I think we have in one way or another taken care of the proposals that we have in terms of the Westinghouse-Pennsylvania Power & Light, which does not fall under the ground rules for the third round and the Florida East Central Nuclear Group which did not fall under it.

These are the kind of things we get. If they do not fall under existing ground rules, we have submitted them for separate authorization.

Representative HOLIFIELD. In each instance they have required additional Government assistance, and therefore we have been faced with the necessity of passing legislation which would make those projects possible.

I wonder if we are going to continue to operate under the third round in the consideration of proposals, always with the method of coming to the committee for additional subsidies, additional assistance of one kind or another, in order to make a new proposal qualify. I wonder if that is the program of the Commission.

Are you planning on bringing in each project which cannot qualify under the third round and request special legislation on it?

Mr. VANCE. I think if you will let me proceed, that question is answered, sir, in the next page or so.

Representative HOLIFIELD. Very well.

Mr. VANCE. If the Commission determines that a specific project is especially timely and necessary but is not otherwise proceeding, the Commission may decide to proceed directly with the design and construction of a Commission-sponsored experimental prototype or it may decide that it is appropriate to seek industrial participation and responsibility for that specific project.

In the latter case, an invitation would be issued for proposals to carry out the development, design, construction, and operation of a developmental prototype with Commission assistance of the type provided for in the previous section. If no acceptable proposal is received within the prescribed time, and judgment as to the need for the project remains favorable, the Commission would proceed with the project under direct Commission responsibility.

Once the Commission assumes responsibility for the project, the Commission will determine the site and project specifications and will endeavor to obtain such participation as may be feasible, consistent with these conditions and with the objective that the project proceed without delay.

Representative HOLIFIELD. At that point, I would like to ask if that is not putting the cart before the horse. If you are going to proceed as you said you would in a previous part of your statement and exercise the Commission's judgment, shouldn't the Commission decide on a generation of a reactor that is needed, or a specific type of development that is needed and then publish that to the industry at large under a time limitation of, say, 60 days, or something like that and then proceed to see that the project is built?

You are putting it here on the basis of arriving at the project specifications and other points after you have not received an acceptable proposal. This comes to the point of deciding whether the Commission is going to have a program which it believes will develop the art and setting that program forth clearly and requesting proposals to proceed along the lines the Commission directs, or whether the Commission is going to sit back as it has in the past and wait for people to come in with a project which they believe to be well fitted to the program.

Mr. VANCE. I think the way should be open for both kinds. In other words, if I understand correctly what you have in mind, you are suggesting that the Commission should decide that it is timely to have reactors built of certain promising types.

Representative HOLIFIELD. Size, specification, and so on.

Mr. VANCE. That is right, and then see if industry is interested, and if not, if the terms are not suitable, that they be built by the Commission. I think in addition to that we should have an open mind if

industry comes to us and says it would like to build a reactor of a certain type.

Representative HOLIFIELD. Providing that the Advisory Committee of technical experts agree with you that this is a type that fits into a furtherance of the art.

Mr. VANCE. Yes, and something that is worthwhile and does hold some promise.

Representative HOLIFIELD. It should not be decided on the basis of an industry willing to put in a certain number of millions of dollars which might or might not be the majority of the money involved, and then you go along with that project just because it is a so-called partnership project.

Mr. VANCE. That is right.

Representative HOLIFIELD. If the project does not fit.

Mr. VANCE. It has to have promise and be meritorious.

Representative HOLIFIELD. Will the AEC take the responsibility of setting up in advance the types of projects which it feels are worthy of immediate attention by industry?

Mr. VANCE. Yes, sir; that is the intent of what I have just read.

The Commission would request specific authorization for each project which is to be carried out under direct Commission responsibility. In cases where it is determined to be appropriate to seek industrial participation and responsibility for identified projects, it may be necessary to request flexibility for proceeding either as a cooperative project or as a completely Government-financed project.

In the case of a cooperative project, Commission assistance would be limited to forms offered under the extension of the power demonstration reactor program, previously described. The Commission may also request specific authorization for proceeding with projects not specifically identified by the Commission, which are proposed by industry, and which are deemed desirable, but which may not completely satisfy established criteria for Commission assistance.

Representative HOLIFIELD. In other words, this is the loophole which you can use to fail to go ahead with an aggressive program?

Mr. VANCE. No; I do not consider it that at all.

Representative HOLIFIELD. Let us take the Pennsylvania Light & Power project, for instance. This was a project that was suggested by these people and they were going to build it themselves and they spent $5½ million and then they threw up their hands and recognized that the job of research and development was greater than they anticipated, so they had to come in and ask for a different arrangement.

It finally evolved in a request for $7 million additional research and development from the Government. This is the type of delay that you are going to have in these advance projects if you depend upon the demonstration program to achieve it.

I can see very little difference in what you are saying here and in the method by which you have proceeded in the past.

Mr. VANCE. I think there is this great difference. We are proposing here a positive program in which the Commission takes the initiative, but we are leaving the door open to consider proposals from industry provided they are meritorious.

Representative HOLIFIELD. How soon can the committee expect you to come forward with a definite, prescribed program—a definitive pro-

gram—of the types, the sizes of reactors which you believe are necessary to be built within the immediate future.

Mr. VANCE. I think that this paper which we are now considering spells that out pretty well for fiscal year 1959 and to a very considerable degree for 1960. I think that we will come before the committee at least once a year and maybe more frequently with revised ideas on this subject, taking advantage of new developments as they come along.

Mr. RAMEY. What criteria will the Commission use to decide whether to construct an experimental prototype directly under contract with industry and the kind that you will go out for proposals under the power demonstration program.

You say if the Commission decides that a project is timely and necessary, but not otherwise, it may proceed to do it directly or it may decide to go on a demonstration round. Is it really feasible to go the demonstration route for a first generation experimental prototype such as the gas-cooled project?

Mr. VANCE. I would say generally speaking that it depends upon the degree of technical knowledge that exists with respect to this concept. However, as you, yourself, said a few minutes ago, industry now seems to be interested in doing some of this work.

Consequently, I think we have a somewhat different situation than we had a year ago.

Mr. RAMEY. This may not be a desirable thing, though, to get industry out on a limb on these risky experimental projects even though some of them have shown this kind of interest. It might not necessarily be desirable in the public interest.

Mr. VANCE. I am not trying to be facetious when I say this, but I do not think we need to be the guardian of people who are managing companies in the power industry.

Mr. RAMEY. But we have an obligation with respect to expenditure of public funds.

Representative HOLIFIELD. You do not have to be the guardian of them but your point of responsibility is—let us take the Pennsylvania Power & Light project as an example—once they decided to go along in a certain field they preempt that particular size, type, and so forth, and then they proceed for a certain number of months or years on it and suddenly they throw up their hands and then it becomes an obligation on the part of the Government, if it is accepted, to come in and throw an additional $29 million into a project which they preempted and you might say set on the shelf as far as governmental consideration is concerned, because private industry is going to do it.

Then, private industry fails to be able to carry forward on it, the Government belatedly comes in and picks up the obligation and goes ahead. This is the lag time, the delay time, which comes about as a result of the failure of industry to do the job. This is what we have been looking at for the last 4 years.

Mr. VANCE. I think the circumstances in the Pennsylvania case are individual to that situation. I do not know of any other case that is parallel to it.

Representative HOLIFIELD. There are other areas in which you had to step in which a cooperative program. Take the Consumers of Nebraska, after a couple of years of negotiations; take the Piqua; take the Chugach.

All of these have been delayed and have delayed the Commission from going ahead with an aggressive program. It is a matter of fleecing them because when you get them in they lose their shirt or they have to throw up their hands and come to the Government.

The point I am getting at is that there is delay involved because of this procedure. I can see additional delay if we are going to follow the same pattern.

Mr. VANCE. I would again say, as I did before with regard to Pennsylvania Light & Power, I think the situation in the case of Consumers and Piqual and some of these other projects which a year ago the committee authorized us to handle directly instead of indirectly——

Representative HOLIFIELD. This is because we saw that we were not getting anywhere. Negotiations were occurring for 20 months, 24 months, 27 months and still nothing tangible in the way of starting a project. After looking at this for several months and seeing the futility of it, the committee had to step in, if the job was going to be done, to see that a formula was developed that would do it.

Mr. VANCE. Those delays, as I see it, were due primarily to the fact that the proposed builders and operators were cooperatives. They themselves were not able to do what they themselves thought they were going to be able to do in the situation.

Representative HOLIFIELD. That is exactly right, and that is what the committee said from the very beginning they would not be able to do. The equipment companies also could not meet their lump-sum proposals. They started revising them upward and so forth.

Mr. VANCE. That is right.

Representative HOLIFIELD. This was the situation which the committee faced. We do not want to be sucked into another deal where we are going to have to face another lagging period of development because of the inability or the unwillingness of industry to go ahead and do the job.

We want to get on with the building of reactors and the second and third generation reactors because of the international situation, I think, more than anything else. That is the only interest I have in it at the present time.

Mr. VANCE. I think we will agree that we cannot expect cooperatives, because of their very nature and how they get their financing, to take on big financial loads in situations of this kind. I think that has been clearly demonstrated.

Representative HOLIFIELD. I think that was clearly foreseen a long time ago by the committee.

All right, you may proceed.

Mr. VANCE. Assistance to nuclear-power projects in other countries obviously must depend upon their willingness to build nuclear powerplants with the assistance of the United States. There may be many limitations on types of assistance which other countries will be willing to accept.

We should bring together into one package all of the various items of assistance which we are prepared to offer our foreign friends who have an urgent need for the rapid development of nuclear power on a commercial basis. The following items should be considered:

(*a*) Availability of our technology and scientific knowledge relating to the production of nuclear power;

(*b*) The pledge to supply enriched uranium required to operate a given reactor over its amortizable life;

(*c*) Reasonable assurance of the availability of acceptable prices of services in connection with the fuel cycle, including fabrication of fuel elements and chemical processing of same at stated prices until such services are available from other sources.

Representative HOLIFIELD. Is the Commission going to be able to set up a realistic program in paragraph (*c*)?

Mr. VANCE. I think so. As you know, industry has already taken up the matter of fabricating fuel elements. Industry has not taken up the chemical processing of fuel elements. The reason is that the volume of business currently available is insufficient to indicate any possibility of profit in that kind of an operation.

I might say that with respect to some of our foreign friends, for instance, the Euratom group, that they anticipate that they themselves will in the relatively near future build and operate chemical reprocessing plants in their own area.

Representative HOLIFIELD. Has the AEC made any progress in standardizing the processing charges over the daily rental charge which was announced a year ago?

Mr. VANCE. Standardization of design has to precede standardization of processing. I say design because the design affects the process. I might say that I think that is one of the great advantages that our British friends have over us.

Representative HOLIFIELD. They are offering a flat service fee.

Mr. VANCE. They offer only a standardized fuel element.

Mr. RAMEY. Wouldn't it be possible to select certain of the more regularly used types of fuel element and make a fixed charge on it?

Mr. VANCE. I think, Mr. Ramey, that the way this thing will develop is this: I believe in the course of time as fuel elements do come back to us for reprocessing that we will find that certain types of fuel elements appear to have the largest possibility from the standpoint of lower cost, and we can quote lower cost on these so-called standardized fuel elements for reprocessing than on the custom-made job that is different and requires a different process.

Representative HOLIFIELD. This is an area in which the Commission should exercise its judgement.

Mr. VANCE. Where the Commission should take the initiative.

Representative HOLIFIELD. Toward standardization. If we are going to take financial responsibility in this field, whether it be in the form of unusual type of loans, or research and development or the actual processing charge itself, plus the charges of waste disposal and so forth, I think this is an area where some technical thinking on the part of the Commission and the outlining of some areas of standardization might well bring about standardized charges which could be made known to the manufacturers and which they could use in their estimates of cost in the development of these reactors for these foreign nations.

Mr. VANCE. I think this is one—not the only one—of the benefits that will come out of this expanded fuel-cycle program to which we previously referred.

Representative HOLIFIELD. But you had a lot of money taken away from you in that field, did you not, for material testing? That would

have been in the field, would it not, of the development of fuel materials?

Mr. VANCE. I understood you earlier, Mr. Chairman, that we would get into the detail of that, item by item, later.

Representative HOLIFIELD. The problem still remains. We may get to it later, and we may forget about it, but the item still remains that the manufacturers I have talked to have complained because at this time they are unable to give to a prospective buyer in Europe, or other parts of the world, a firm estimate on this factor in the cost of operation of the reactor.

Mr. VANCE. On chemical reprocessing?

Representative HOLIFIELD. Yes.

Mr. VANCE. Specifically?

Representative HOLIFIELD. I think that is true.

Mr. DAVIS. Mr. Holifield, the Commission has established a formula which gives a perfectly correct way of estimating the chemical-processing charges. It does not cover all of the steps. There are still some things that industry has to do, itself, such as getting from UF_6 to UO_2, but the formula, as I understand it, is a direct estimate of the cost of processing based on the amount of material to be processed and the size of the batches and their enrichment. I think this has been pretty clearly established.

Representative HOLIFIELD. There must be some factors which they cannot compute, because they still make the complaint that this is an area where they cannot definitely give to their prospective buyer a definite price, and that it has an effect upon the kilowatt cost.

Mr. VANCE. I think I can explain to you what it is. It is not the reprocessing charges. In the negotiations with foreign prospective buyers, the cost of the fuel cycle, taken as a whole, and that includes not only reprocessing, whereas, Mr. Davis said the charge can be computed accurately, but it includes fabricating cost and it includes a guaranteed life of the fuel element. It is all three factors that come into the picture.

Representative HOLIFIELD. That may be right.

Mr. VANCE. It is in the fabricating cost and in the guaranteed life of the fuel element where the uncertainties exist, and not in the reprocessing charge.

Representative HOLIFIELD. This may be so, particularly the life of the fuel element.

Mr. VANCE. That is right.

Representative HOLIFIELD. You may proceed to the implementation on page 17, and then we will adjourn.

Mr. VANCE. Item (*d*) Contracts to purchase plutonium produced in reactors abroad for a reasonable period.

(*e*) Sale on the installment plan, as well as the sale outright, of enriched-fuel inventory and, in appropriate cases, the lease of such inventory.

(*f*) Capital loans for foreign nuclear-power installations through Export-Import Bank under the same terms and conditions as such loans have been made to finance conventional-power installations.

(*g*) Continuation and, if necessary, expansion of our facilities for training foreign technicians, without whom reactors cannot be operated.

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(*h*) Some means for solving the problem of third-party liability which might accrue to American manufacturers on account of installations abroad. The Commission recognizes that the responsibility for solving this problem rests with the individual nation concerned, but that they should be urged to bring this problem to early resolution.

(*i*) A firm declaration of our intention to support, over an indefinite period, an expanded fuel-cycle development program pertinent to improved performance of reactors to be built abroad with assistance from the United States—such support would be given to manufacturers in the United States, who would sell fuel elements abroad, but might also be given to foreign manufacturers.

The Commission is developing a cooperative program specific to Euratom and the six countries of Western Europe involved therein. Such a program, if timed properly, can be of great assistance to the development of economically competitive nuclear power in the United States.

Do you wish to stop at that point?

Representative HOLIFIELD. I think we had better stop at that point, except that I would like to ask you one question: When do you think that the Commission will be able to place before the committee this specific Euratom proposal?

Mr. VANCE. I have a little difficulty in specifying a time, for the reason that there are several major questions that have not yet been resolved.

Representative HOLIFIELD. We will not go into it now. We will accept your answer that, at this time, you cannot tell the committee.

Mr. VANCE. For instance, one of these questions involves the International Agency. We have asked Mr. Cole to come over here to talk to us about it. We tried to get him over here the last weekend. Whether he can come in a few days later, I do not know. We have to settle that, among other things, before we can present a program to you. I would think that it should be within a matter of days.

Representative HOLIFIELD. The committee will again meet in this room at 2 o'clock this afternoon.

AFTERNOON SESSION

Representative HOLIFIELD. The subcommittee will be in order.

Mr. RAMEY. During the latter part of the morning's discussion, there where a couple of questions and points that it might be desirable to clarify, Mr. Vance.

Do I take it that, on this question of the first generation prototypes and the role of industry in their construction under the demonstration program, you would take that to be the exception rather than the rule?

STATEMENTS OF HAROLD S. VANCE, COMMISSIONER; JOHN S. GRAHAM, COMMISSIONER; JOHN F. FLOBERG, COMMISSIONER; W. K. DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; DON BURROWS, CONTROLLER; F. J. McCARTHY, ASSISTANT CONTROLLER FOR BUDGETS; L. OLSON, GENERAL COUNSEL; A. TAMMARO, ASSISTANT GENERAL MANAGER FOR RESEARCH AND INDUSTRIAL DEVELOPMENT; U. M. STAEBLER, DIVISION OF REACTOR DEVELOPMENT; AND DELMAR MORRIS, DIVISION OF REACTOR DEVELOPMENT, ATOMIC ENERGY COMMISSION—Resumed

Mr. VANCE. That is right.

Mr. RAMEY. Normally, under the demonstration program, you would except industrial proposers to come in with well-established concepts on second and third generation plants?

Mr. VANCE. That is right. I think the confusion, Mr. Ramey, probably arose out of the fact that I tried to say that I didn't think we should close the door to industry proposals, even though they might be of a type or concept that we, ourselves, had not included in the list of desirable ones.

For example, the case of the new Florida proposal which resulted from advice which the group got from Dr. Zinn, his belief being that the reactor which they are now proposing to build holds great promise.

Mr. RAMEY. What would your position be on having it as the normal process under the demonstration program of the Commission designating the second or third generation project that it was interested in supporting and soliciting proposals from industry to participate in such a project?

That would be the normal way that the program would operate.

Mr. VANCE. That is right. Without completely closing the door to suggestions running the other way.

Chairman DURHAM. In other words, if the industry got something we could learn from them.

Mr. VANCE. That is right.

May I resume, Mr. Chairman?

Representative HOLIFIELD. You have finished several points here, which as I read it, most of them apply to the Euratom program. That program, of course, will require legislation, will it not?

Mr. VANCE. Yes, sir.

Representative HOLIFIELD. And authorization of funds and specific assistance. You have testified that you will bring those matters or this proposal to us in a definitive form in the very near future. I think we might as well wait for your proposal and then we can go over these items in the light of your proposal. So we can proceed with page 17, immediate implementation.

Mr. VANCE. I think it would be appropriate, Mr. Chairman, that I should say at this time in view of the fact that I mentioned we wanted to consult Mr. Cole on this matter, that I am sure that the committee realizes the Euratom is a new organization and that the interna-

tional agency which Mr. Cole heads is a new organization. The six countries which make up the Euratom group are themselves members of the international agency but the Euratom group as such is not. We want to be sure that as these two new organizations start their operation that nothing we do with one is in any way going to interfere with another.

Now is the time to be sure that there is no interference and not after some agreement has been made.

Representative HOLIFIELD. In other words, these six nations in Euratom are individual members of the international agency?

Mr. VANCE. That is right.

Representative HOLIFIELD. Any deal with them as a group would be a separate arrangement completely apart from a program with the IAEA?

Mr. VANCE. That is right.

Representative HOLIFIELD. However, it might set the pattern for additional nations in IAEA to request the same type of arrangement?

Mr. VANCE. That is correct, sir.

Representative HOLIFIELD. I think the committee should also hear from Mr. Cole when he gets back as to his experience over there with this international agency and find out how it is working out.

Mr. VANCE. The next subheading, Mr. Chairman, is immediate implementation. It has been pointed out that assistance to other countries may require projects even in the domestic program which might not be required otherwise; also, that the results from assistance to other countries will contribute greatly toward meeting the domestic objective of the program. The urgency is dictated primarily by international considerations, but the overall program should be an integrated one.

The fiscal year 1959 authorization bill proposes $65,300,000 for three civilian power construction projects and $22,809,000 of additional authority for cooperative arrangements with industrial participants in the development of civilian power reactors; $10 million is requested for hot cells and expanded facilities for the development of fuel technology. Among the projects included in our proposed fiscal year 1959 program are the gas cooled reactor and the heavy water reactor.

Gas-cooled power reactor: This project is to provide a moderate sized, graphite moderated, gas-cooled, experimental reactor designed to explore gas as a coolant for civilian power reactors. It will seek to achieve temperatures and power densities believed essential to achievement of economical nuclear power in the United States from this type plant. Current technology strongly indicates that this will require nonmetallic, partially enriched uranium fuel. The reactor will be designed primarily as an experimental facility for exploring operating temperatures higher than currently planned in any gas-cooled civilian power reactor.

The Commission will proceed with development and design of this reactor. During this period of several months prior to the start of construction, industry will be given an opportunity to submit proposals for bearing or sharing in the cost of the project.

Representative HOLIFIELD. What are the AEC plans for obtaining industrial participation in the gas-cooled reactor?

Mr. VANCE. Only that a short period, such as I have stated here, will be given for industry to come forward with proposals.

Representative HOLIFIELD. Can you pin that down in terms of time?

Mr. VANCE. I should say 2 or 3 months.

Representative HOLIFIELD. Have any of the industrial firms expressed an interest in this matter?

Mr. VANCE. So far as I know, they have not.

Representative HOLIFIELD. Does it make much sense, then, to put up an experimental facility such as this for industry participation as long as there has been no particular interest shown?

Mr. VANCE. Yes, I think there is. As you will recall, we discussed this morning one of the objectives or one of the measures, let us say, in our effort to achieve economic power is to develop higher operating temperatures. That is one of the potentials that we have to emphasize. It does appear that a higher operating temperature is greater with a gas-cooled reactor of this type than with a liquid-cooled reactor.

Mr. RAMEY. But it is not likely, with this being such an experimental type of project, that industry would want to come in on it under the demonstration program?

Mr. VANCE. If you ask me what the odds are, I would agree with you, they probably will not.

Representative HOLIFIELD. This is the item of $51 million in the budget?

Mr. VANCE. I think the total is about $51 million.

Representative HOLIFIELD. In your bill, section 110, you provide that the appropriation authorized in section 101 of this act for project 59–D–10, gas-cooled power reactor, shall also be alternatively available for a cooperative program under which the Commission may enter into an agreement for cooperation with public, private, or cooperative power groups, equipment manufacturers or others under which the organization will design, construct and operate the reactor at its own expense and the Commission will contribute to the cost of research and development programs necessary for the construction and research and development activities carried on during and in conjunction with the experimental operation of the reactor and will furnish such other assistance as the Commission deems appropriate, not including, however, any contribution of funds to be employed in the construction or operation of the reactor except under contract or other arrangements entered into pursuant to section 31 of the Atomic Energy Act of 1954 as amended.

When you talk about this gas-cooled power reactor and industry participation, you are talking about the authorization that you are asking for in section 110 as your alternative procedure, is that right?

Mr. VANCE. That is right.

Mr. RAMEY. Why did not the Commission request authorization of provisions to cover in the event that the Government were to construct the reactor?

Mr. VANCE. We are. That is what the $51 million is for. That is on the assumption that it will be constructed by the Government.

Mr. RAMEY. In the current authorization act for 1958 it has certain provisions in there about absorbing the power at the Government site in the event the Government constructed a prototype reactor. This was confined to the plutonium recycle reactor. It also had pro-

vision for the disposal of the reactor after it has served its research and development purpose. It would seem that language like that, if the Government were serious about constructing this, would be necessary and desirable in such event.

Mr. VANCE. I wouldn't think it would be necessary, and my own opinion is that it is not desirable. I might point out to you that the reason for those provisions in the previous authorization that you speak of was because at that time we were considering large power installations. The Joint Committee agreed with the Commission that the Commission should not be put into the power business. That was why the previous authorization said it shall be located on Commission sites and that the power should be consumed in Commission operations. I don't think that would apply to a reactor of this type and size.

Representative HOLIFIELD. It was about the same size?

Mr. VANCE. No. I think the reactor contemplated here is 40,000 kilowatts. That is a relatively small one.

Mr. RAMEY. That is all this related to last year.

Representative HOLIFIELD. I think our backup material will show that was about the same size prototype reactor.

Mr. RAMEY. Subsection (c) of section 110 of the current authorization law provides:

> The prototype power reactor facility constructed under this section shall be operated by or under contract with the Commission for such period of time the Commission determines to be advisable for research and development purposes and for such additional periods of time as the Commission may determine to be necessary for national defense purposes and for the purpose of subsection (a) of this section. Upon the expiration of the prototype reactor operation as determined by the Commission in accordance with this subsection, the Commission shall dismantle the reactor and its appurtenances.

Subsection (a) refers to the specific projects in section 101, namely, the gas-cooled reactor and the plutonium recycle in the original bill, and as the law passed, it was just the plutonium recycle.

Subsection (b) provides for the Commission to solicit participation by private industry in such a project. It reads as follows:

> In the conduct of the work under this section the Commission is authorized to obtain the participation of private, cooperative, or public power organizations to the fullest extent consistent with Commission direction of the project, ownership of the reactor, and utilization of the energy generated.

Mr. VANCE. My recollection of that provision is that it was put in there to avoid the necessity of the Commission itself operating the reactor. I think that referred to the operation, not the construction.

Mr. RAMEY. I think it was both.

Representative HOLIFIELD. This says that the electric energy generated shall be used by the Commission in connection with the operation of such installation. That is in subsection (a) and that referred to the location of this reactor at an installation operated by or on behalf of the Commission. This did refer specifically to a reactor of this size, and therefore, the specific language which was in section 110 of the old law, it seems to me, would be necessary for this law if we plan to go ahead on it with this authorization.

Mr. VANCE. I certainly don't think it is necessary, Mr. Chairman.

Representative HOLIFIELD. We do not want this thing to hang fire if we authorize it. We want it to be expeditiously constructed.

Mr. VANCE. So do we.

Mr. RAMEY. If this were constructed at Idaho, for example, wouldn't it be desirable to have language like this?

Mr. VANCE. No, I don't think so.

Representative HOLIFIELD. What would you do with the power?

Mr. VANCE. If this restrictive language is not in the bill that doesn't mean we cannot locate it at Idaho Falls nor does it mean we can't use the power there to the extent of our needs.

Representative HOLIFIELD. What is your need for power at Idaho?

Mr. VANCE. I don't know.

Do you, Mr. Davis?

Mr. DAVIS. This depends somewhat on how many facilities go in there. We have estimated that our needs would probably be such that we could absorb the power most of the time from such a reactor and also from the EBR–2 which, as you know, will go there and will also produce about 16,000 electrical kilowatts of power. It will be roughly comparable with our demands at the site as we now visualize them several years from now.

Representative HOLIFIELD. It doesn't seem to me that it makes sense to have this put up for grabs, you might say, in the power demonstration program if you intend to go ahead with it. It seems to me that this is a project, according to your testimony, that the industry has shown no interest in, and therefore, in case it is authorized a further delay for industry participation would just mean a delay.

Mr. VANCE. I don't think 2 or 3 months would delay because, as we say in the statement, we will go ahead with the design work on the assumption that it will be a Government-built reactor.

I think I can assure you that if we have this leeway it will not result in any delay.

Representative HOLIFIELD. We have the conceptual design already on that, do we not? I mean the preliminary design?

Mr. VANCE. I don't know how far it has gone.

Mr. DAVIS. On the particular reactor that is visualized here we will not have the comparable design to the natural uranium reactor that we submitted on April 1 until about August 15. This will be the completion of the so-called title I design. The title II design or the definitive design, would be started then and would not itself be completed for probably something close to a year, although construction could start toward the end of that period.

On our data sheet we don't show that the physical construction would probably start before early spring of 1959 in any case. So I don't believe this would actually lead to delay in the initiation of actual construction.

Representative HOLIFIELD. I think we will want to have a commitment on the part of the Commission in regard to the time period which you will put this up for participation so that we would have a definite understanding as to when you would go forward on it if it is authorized.

Mr. VANCE. We will make a definite commitment on that, Mr. Chairman.

Chairman DURHAM. Will you say who is designing it? Is the Commission designing it or is it some other company?

Mr. DAVIS. Mr. Durham, the design work is being carried out by Kaiser Engineers and ACF Industries as a part of the contract where they did the studies of natural uranium reactors as well.

Representative HOLIFIELD. As to definite commitments, you know we had a little experience with a similar reactor last year when the committee made certain recommendations which were ignored. We suggested the use of the Bettis Laboratory, and some of the Rickover organization, and later on a different procedure was adopted by the AEC and you paid very little attention to the committee's recommendation last year. You cut the power out of the recycle project. We are going to want some definite commitment on this from the Commission, or we will have to write it into the law.

You may proceed.

Mr. VANCE. Heavy water power reactor: The Commission announced in January 1957 that it would be desirable to build a heavy water moderated power reactor which would be operable on natural uranium fuel. No acceptable proposal from industry has been submitted under the existing ground rules of the power demonstration reactor program; therefore, it is considered appropriate for the Commission to assume the initiative in furthering this project. We propose to proceed with design and construction of a heavy water component test reactor plus design evaluation and preliminary design of a heavy water moderated power reactor. The plant must be of sufficient size to be operable with a reasonable fuel cycle with natural uranium but would be expected to achieve lower power costs with some enrichment of the fuel. Industry will have an opportunity to submit proposals for participation in later stages of the project as the development and design proceed.

Representative HOLIFIELD. That does not refer to the type of reactor of the Florida project; does it?

Mr. VANCE. No, sir.

Representative HOLIFIELD. I referred a few minutes ago to the report of the committee and I will read now for the record the portion that I referred to:

> The committee is of the opinion that the smallest practical prototype of a natural uranium gas-cooled reactor should be designed and constructed as soon as practicable. It is believed that the reactor developed should represent an advance on the Calder Hall technology with, for example, higher temperature fuel elements. It is understood that the gas-cooled prototype reactor contemplated in the bill can be so designed as to operate on natural uranium fuel initially but later can test out the feasibility of slightly enriched fuel elements. In view of the availability of the AEC installation at Bettis and Idaho, including able designers and engineers of the Bettis group, and the willingness of Admiral Rickover to undertake direction of a gas-cooled reactor project, it would appear essential that this project be assigned to the Naval Reactors Branch under Admiral Rickover.

This recommendation of the committee was completely ignored by the Commission and another tack taken.

Are there any further questions?

Chairman DURHAM. I have none.

Representative HOLIFIELD. You may proceed.

Mr. VANCE. We have prepared a brief summary of civilian power reactor projects which as we see the situation at this time may be desirable for initiation during the period from fiscal year 1959 through fiscal year 1963. We also have prepared a tabular summary of pre-

liminary technical features of projects projected for fiscal year 1959 and fiscal year 1960. With the committee's permission this material is submitted for the record.

Representative HOLIFIELD. I think we will go right through that if you will continue reading on it, because we need to become familiar with this part of it as well as the other.

Mr. VANCE. Projection of civilian power reactor development program:

1. Continued rapid progress in the development of nuclear power reactor technology and in the reduction of nuclear power costs requires not only continued research and development in the laboratory but also design, construction, and operation of power reactors. Projects for the building of reactors provide a focal point for the reasearch and development effort and assure that all of the scientific and engineering problems receive attention. Once built these reactors provide technical data and operating experience which cannot be obtained in any other way.

Representative HOLIFIELD. Mr. Vance, if you wish, it is perfectly all right with the committee if one of the other Commissioners continue reading to give you a rest.

Mr. VANCE. Thank you, Mr. Chairman. Perhaps Mr. Graham could continue.

Representative HOLIFIELD. Very well.

Mr. GRAHAM. Paragraph 2:

In view of the rapidly changing status of nuclear power technology, it is impossible to make firm and specific projections of desirable reactor projects very far into the future. An indication of projects which might be desirable during the period from fiscal year 1959 through fiscal year 1963 has been prepared and is summarized below. This summary of reactor projects has been prepared without reference to where they should be built, by whom they should be built, or the arrangement under which they should be built.

The projects have been selected tentatively on the basis of providing steady progress in a broad base of technological development and providing sufficient generations of successively improved plants to achieve cost reductions through engineering and operating experience. Actual selection and scheduling of projects will be very much dependent upon future evaluation and judgments related to the overall planning of the Commission and industry.

Fiscal Year 1959: 3. The BORAX and EBWR facilities should be modified to extend boiling water reactor technology and to explore radical departures in design.

Representative HOLIFIELD. You have a $6.5 million item in your request that will partly take care of that portion, I believe, and the breakdown as given to us shows EBWR $3 million, BORAX $1.3 million, OMRE $2 million, giving a total of $6.3 million. You are referring to that, are you not, at this point?

Representative HOLIFIELD. This would be referring to the BORAX and the EBWR. What kind of changes are you planning on that?

Mr. GRAHAM. Yes, sir; this is what we were referring to.

Mr. VANCE. I suggest Mr. Davis respond to that question.

Representative HOLIFIELD. Mr. Davis, will you give us that information on project 59–D–7?

Mr. DAVIS. Yes. For the EBWR we plan to make modifications which would allow us to dump more heat and to explore the higher power range in the reactor and to try out forced circulation since it is presently a natural circulation reactor and also to try the reactor with heavy water. These would be modifications to make use of the EBWR as a flexible reactor experiment. In the case of the BORAX reactors, as you know, this has been a series of reactors, the latest one which has about reached the end of its useful life is BORAX 4 in which we have been running thorium-uranium oxide fuel elements. We plan to put in a new pressure vessel and a new pit and to continue the experimentation there, pushing the limits of the experimental work with the boiling water reactor there still further.

Representative HOLIFIELD. Will that increase the output of the EBWR, those modifications?

Mr. DAVIS. It would probably allow us to take more heat generation. It would not increase the electrical output in any way. We do not plan to put in a larger turbo-generator.

Representative HOLIFIELD. I don't know whether you picked up the OMRE modifications. You might give us the modification on that.

Mr. DAVIS. The OMRE, as I think you know, was built originally as essentially a feasibility experiment. It did not have very many provisions for experimental adaptations for the reactor or experimental facilities at the reactor site. We did this because we felt it was a sort of go, no-go experiment. Either the organic material was going to stand up in a satisfactory way or it was not. So it was built as a minimum cost feasibility type of reactor experiment.

The money here for the alterations is so that now that it has been successful we can go ahead and try some other types of moderators, perhaps other types of fuel elements and expand its use as a flexible reactor experiment.

Representative HOLIFIELD. This is the same type as the Piqua project, is it not, approximately?

Mr. DAVIS. Yes, sir; this is exactly the same type.

Representative HOLIFIELD. Your funding on this would be kept separate from the Piqua?

Mr. DAVIS. Yes, sir.

Representative HOLIFIELD. But the technology you learn there will be adaptable for use in the Piqua project?

Mr. DAVIS. Yes, it would be.

Representative HOLIFIELD. All right, Mr. Graham, you may proceed.

Mr. GRAHAM. No. 4: Construction of a small-scale boiling water nuclear powerplant may be started. This plant is visualized as the best commercial adaptation of boiling reactors consistent with current technology. It is assumed that this will be done as a cooperative project with RCPA.

Representative HOLIFIELD. This speaks of the Elk River project.

Mr. GRAHAM. Yes, sir.

No. 4: Construction of a small-scale organic moderated and cooled nuclear powerplant based on OMRE operating experience may be initiated. It is assumed that this will be done as a cooperative project with Piqua, Ohio which, Mr. Chairman, I believe was your previous question to Dr. Davis.

Representative HOLIFIELD. Yes. It might be well to note here that the committee has waived the 45-day period on those two projects and the Commission is free to go ahead now.

Mr. GRAHAM. Thank you, sir.

Representative HOLIFIELD. You may proceed.

Mr. GRAHAM. No. 6: Construction of a heavy water components test reactor should be initiated as part of the development effort to support building a large-scale heavy water moderated power reactor operable on natural uranium.

Representative HOLIFIELD. What would the nature of this be in terms of funds? How much funds would you need for this type of a thing?

Mr. GRAHAM. I will try to answer your question, sir.

Representative HOLIFIELD. Is that the $8 million item, 59–d–8, heavy water components test reactor, $8 million?

Mr. GRAHAM. I think that is the same one we referred to previously, is it not, Dr. Davis, on page 18 of the testimony?

Mr. DAVIS. Yes, this is item 59–d–8 in the authorization bill.

Representative HOLIFIELD. This would be a nonpower-producing reactor and strictly a test type of reactor; would it not?

Mr. DAVIS. This is a reactor, Mr. Holifield, which is for the purpose of making tests of the fuel elements and of some of the components that go into the handling and containment of the heavy water. Since it is to be a test reactor, it could be operated in a very flexible manner. We don't think it is practical to hook up any kind of power generation with it.

Mr. VANCE. Mr. Chairman, I wonder if it would not be appropriate at this point for Mr. Davis to explain why this appears as a test reactor in the program whereas we previously in our informal discussions with the committee had talked about full-scale construction.

Representative HOLIFIELD. Yes.

Mr. DAVIS. Previously we had actually talked about both of these going on. The situation is that we have had quite extensive studies as well as a very considerable amount of research and development work done, primarily by du Pont, but the work that has been done by some of the other groups has had some bearing on this.

Although I think it is possible at this time, based on the work that has been done, to go ahead and actually build the heavy water power reactor, it is also pretty clear to us that at this time we would not be able to make an intelligent selection of exactly which type and some of the features of it which ought to be incorporated if it was in fact to be a major advance in this field. We feel that something like probably another 9 months of work, both research and development and design evaluation studies, are necessary before we are able to select the exact configuration and type of heavy water reactor which would show the best potential of being built as a large-scale plant.

Representative HOLIFIELD. Was this decision made on the basis of technology or on the basis of pressure from the Budget Bureau?

Mr. DAVIS. This decision was made on the basis of a thorough program review which I conducted with the du Pont people as the result of their research and development and design studies. It was recommended by the Division to the Commission.

Representative HOLIFIELD. Do you have enough design money to go ahead with this? Will this $8 million give you enough money to do this job?

Mr. DAVIS. This money is only for the design and construction of the heavy water components test reactor. The money for the research and development work and for the design studies would be in our operating budget.

Mr. RAMEY. Did you get all the money you requested for this purpose?

Mr. DAVIS. I believe we certainly have enough to carry out the job; yes, sir.

Mr. RAMEY. On the time schedule that you requested?

Mr. DAVIS. Yes, sir.

Mr. VANCE. I would call your attention, Mr. Ramey, to the fact that on the next page under fiscal year 1960 this full-scale reactor does appear.

Representative HOLIFIELD. You may proceed.

Mr. GRAHAM. Thank you, sir.

Item 7: The project for a heavy water moderated reactor operable on natural uranium fuel should be continued and expanded. Principal effort during fiscal year 1959 will be on design evaluation and research and development. Preferred design specifications will be established and preliminary design may be carried out during the year.

8. A project for construction of an experimental gas-cooled reactor prototype should be initiated. The objective of this project should be the development of technology of gas cooling at the highest temperature now considered feasible and consistent with the objective of producing low-cost power in civilian power reactors.

Current technology dictates that these conditions require nonmetallic, partially enriched uranium fuel. The reactor should be designed to facilitate testing of advanced fuel elements and other key components in sizes and under conditions meaningful for evaluation of a large-scale gas-cooled power reactor. A design power level of about 40 EMW appears appropriate.

Representative HOLIFIELD. This refers to Project 59-d-10, the $51 million?

Mr. GRAHAM. Yes, sir.

Representative HOLIFIELD. Will this reactor be capable of using nonenriched uranium fuel?

Mr. GRAHAM. May Dr. Davis speak to this?

Mr. DAVIS. It would not be capable of operation on a complete natural uranium loading. It would be, however, possible to put in some natural uranium fuel elements and test them out. As planned, it could not operate with a complete charge of natural uranium.

Representative HOLIFIELD. Could you get technological data from a mixture of the enriched and nonenriched fuel elements?

Mr. DAVIS. You would certainly learn a great deal about the performance of the fuel elements. You would not be able to learn a great deal about the long-term reactivity problems. You would have to have a reactor completely fueled with natural uranium.

Representative HOLIFIELD. You could measure the economics of the natural uranium fuel rods in a mixed fuel reactor.

Mr. DAVIS. The principal thing that determines the economics of the natural uranium fuel is the limitations on the lifetime of the fuel due to radiation damage and this can be ascertained in such a reactor.

Representative HOLIFIELD. The time of burnup or the length of life of the fuel rod can be determined.

Mr. DAVIS. The length of life as limited by radiation damage could be determined and this is certainly one of the principal limitations.

Senator DWORSHAK. Mr. Graham, this paragraph 8 refers to this experimental gas-cooled reactor prototype. Then you mentioned the reactor should be designed to facilitiate testing of advanced fuel elements and other key components in sizes and under conditions meaningful for evaluation of a large-scale gas-cooled power reactor.

I am wondering if this description is not somewhat inconsistent with section 110 of H. R. 12459. What I would like to know is whether this project is of particular interest to AEC at this time, because of the need or the desirability of a gas-cooled reactor which I presume is somewhat comparable to the Calderhall power reactor used in Britain; or whether it is to be used primarily for the generation of nuclear power. What are we dealing with, an experimental project or one designed primarily to generate power?

Mr. GRAHAM. Senator, it is our thought that this is in the experimental category of trying to prove out the higher temperatures that possibly can be reached in the gas-cooled field. If there are any other technical details about this, maybe Dr. Davis could be helpful to you. I would like him to do it.

As you know, I am not very much of a technician.

Senator DWORSHAK. The question that bothers me is whether a private industry plant will make available the testing reactor that you need to evaluate this kind of a power generator. Can you accomplish these somewhat diverse objectives with a single plant operated by a private company?

Mr. DAVIS. You can certainly accomplish a good part. The real problems that one has here revolve generally around the fuel elements and the operation of a high-pressure, high-temperature gas system. The problems are not so much in some of the more basic areas. So the kind of things you will learn here by long-term continued operation are basically the kinds of things that you are after. The fuel elements, if they have the kind of a life that you would like them to have in such a reactor, will last probably something like 5 or 6 years. You are not going to be putting in one batch of fuel elements this week and another batch next week because you will not find out what you want to know about any one batch of fuel elements until they have been in the reactor 5 or 6 years, and in some cases it might even be longer. It is a different kind of operation than the kind of operation we think about in connection with the organic moderated reactor experiment, or something of this sort.

Senator DWORSHAK. Are you reasonably sure that private industry will make available facilities for this kind of testing and for developing research of this type of a reactor? It is my concept that private industry is essentially interested in a profitable venture, whether it is a nuclear powerplant or some other business enterprise. I want to know whether you feel satisfied, or the Commission, that you can accomplish your purpose with a plant of this kind operated by private industry instead of relying upon the facilities of AEC.

Mr. DAVIS. Senator, I think this goes back to the question that Mr. Vance answered earlier about the possibilities and likelihood of getting private industry to do this.

Representative HOLIFIELD. As a matter of fact, one of the drawbacks to private industry doing it is that this is an experimental reactor prototype and you would want to be conducting experiments on it as you used it, and therefore it would not be on the power line steady. Is that not right?

Mr. VANCE. That is right.

Representative HOLIFIELD. It would be more flexible because it was an experimental type and therefore it would be less valuable to a private industry participant because of the shutdown periods, the changing of cores and all that sort of thing.

Mr. VANCE. I think a simple and direct answer to the Senator's question is this: That a proposal from private industry to build this reactor would not be acceptable to us unless the proposal did provide that we were going to get the research and development information we want.

Senator DWORSHAK. Possibly it would be necessary for the AEC to compensate private industry for this information so it would be a cooperative project.

Mr. VANCE. That is correct.

Senator DWORSHAK. While it would be owned and operated by private industry, the interest of AEC would supersede the need of generating nuclear power and would take priority over the optional use of a prototype plant.

Mr. VANCE. That is right.

Mr. GRAHAM. Item 9: Detailed design of the liquid metal fueled reactor experiment No. 1 may be initiated. This reactor experiment is based upon a high-temperature circulating-fuel system.

Item 10: Plans for a small-scale reactor experiment on a new reactor concept selected from many (10 to 12) current studies may be started. One to two years of additional research and development may be required before actual construction of the reactor could begin.

Representative HOLIFIELD. That number 10 is very indefinite.

Mr. GRAHAM. Ten or even 12. It said 10 to 12.

Representative HOLIFIELD. Item 10?

Mr. GRAHAM. Yes, sir.

Representative HOLIFIELD. I was referring to paragraph No. 10.

Mr. GRAHAM. Yes, sir.

Representative HOLIFIELD. This is a very indefinite statement on the part of the Commission. You have not firmed up any proposal under that area?

Mr. GRAHAM. Would you like Dr. Davis to speak at all about some of these?

Representative HOLIFIELD. Would you like to respond to that? This seems to be quite vague, Dr. Davis. You haven't asked for any money for this particular area in paragraph 10, have you?

Mr. DAVIS. No, sir.

As you know, we are continually conducting design evaluation studies and some limited experimental work on quite a large variety of different ideas that both our laboratories and various industrial people have proposed. This item is in here just to represent the pos-

sibility that we might feel that one of these had gotten to a point where they might justify a reactor experiment. As of the present moment, I don't know of any concept that we feel at this particular moment might justify building a reactor experiment.

Representative HOLIFIELD. This would apply to the Puerto Rican reactor, too?

Mr. DAVIS. It was not intended to apply to that; no, sir.

Representative HOLIFIELD. But the Puerto Rican reactor would be a small-scale reactor experiment. When you blanket this group here as not being ready for any type of construction, I would have to interpret that as meaning that that would apply also to the Puerto Rican experiment.

Mr. DAVIS. We have no idea what they would propose as the Puerto Rican reactor. I don't think it would be a reactor experiment the way we visualize reactor experiments at the present time.

Representative HOLIFIELD. Would it be a prototype?

Mr. DAVIS. I would think it would be a small prototype.

Representative HOLIFIELD. Are you depending on the Puerto Rican Power Authority to make a suggestion in the field, or is the Commission going ahead on this and taking the initiative in suggesting the type, size, and so forth?

What is the situation now on that? You may remember that when this was suggested to us before the committee found the Commission's plans in the field of the Puerto Rican reactor very vague as to type and specifications and size and so forth. We could find no comfort in anything that was given to us that it would amount to any type of an advancement in the art.

Mr. Durham under date of April 25 sent a letter to Admiral Strauss in which he inquired about this matter. On May 28, a month later, the Chairman, Mr. Durham, received a letter back from Admiral Strauss in which he said:

> We have given the project no further study since it failed of approval at the authorization hearing last year, but in view of your letter we will review the project. Since such a review will necessarily involve not only the questions you have raised, but also ascertaining the conditions under which the Water Resources Authority may be willing to proceed with a plant, it may not be possible to provide you with our views by the time of the authorization hearings.

We are to understand from that, then, that the Commission has no plans to proceed under the 1959 fiscal budget authorization for a power reactor in Puerto Rico, is that right?

Mr. VANCE. I think that is right.

I might state in explanation of the situation, Mr. Holifield, that in our negotiations of more than a year ago—in other words, prior to the time when this project was included in the 1958 budget request for authorization—numerous conferences were held with the power authority in Puerto Rico. They set up certain conditions which were in the Commission's view unacceptable. In other words, they wanted the Commission to contribute very largely to construction cost and to subsidize its operation later.

We felt there was no justification for that degree, to say nothing of that type of assistance.

Representative HOLIFIELD. Then you have given up because of the fact that the committee turned down your request a year ago? We turned it down for the definite reason that you were vague in your

presentation to the committee. You had no firm plans that would indicate to the committee that you were going to suggest a reactor which would further the art. We can only come to the conclusion that you were not very enthusiastic about the matter or you would have completed your studies and given us some firm suggestion at this time, which would have been completely in line with your paragraph 10 here.

Mr. VANCE. Depending on the type of reactor.

Representative HOLIFIELD. Yes.

Mr. VANCE. Depending on the type of reactor.

Representative HOLIFIELD. It was because you didn't have any firm ideas as to the type of reactor, except maybe a duplicate of a PWR that we turned down a request for before.

Mr. VANCE. Yes, that is right.

Representative HOLIFIELD. It was not because the committee was not in sympathy with the general idea of having a test reactor of this type in South America. At this time I will put in the record the letter from Chairman Durham and the reply from Admiral Strauss on this matter.

(The letters referred to follow:)

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
April 25, 1958.

HON. LEWIS L. STRAUSS,
Chairman, United States Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: This is to inquire as to whether the Commission is giving any consideration to the development and construction of a power reactor prototype in Puerto Rico.

As you will recall, the Puerto Rico power reactor project which was recommended by the Commission last year was eliminated by the Joint Committee primarily because it was not clear as to whether the reactor would represent an advance in the art and also as to whether there was any need for atomic power in Puerto Rico economy and comparable economies in other Latin American countries.

It seems to me that it would be appropriate for the Commission and the Joint Committee to reconsider the desirability of developing a power reactor prototype for Puerto Rico if the above considerations could be met. The desirability of having a prototype reactor in Puerto Rico as a demonstration for Latin America also may become more important because of the indication that no other power reactors are apparently going to be built in South America by the United States for several years at least.

It would be appreciated if you would provide the Commission's views on this subject by the time we hold authorization hearings on the reactor program.

Sincerely yours,

CARL T. DURHAM, *Chairman.*

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., May 28, 1958.

HON. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: I have your letter of April 25, 1958, regarding the development and construction of a prototype power reactor in Puerto Rico.

The Commission's views on the Puerto Rico power reactor project were expressed in the hearings on the fiscal year 1958 authorizing legislation. At that time it was pointed out that the project would provide a means of demonstrating the feasibility of a water-cooled and moderated heterogeneous power reactor, it would be a means of promoting the atoms-for-peace program in Latin America; and it would also provide practical training to Latin American scientists and

engineers. In connection with this last point, the plant was considered as a part of the nuclear training center which is being established by the University of Puerto Rico and the Atomic Energy Commission. As you may recall, I was personally very much in favor of this project, and continue so to be. I have discussed it with Governor Muñoz Marín and with officials of the Puerto Rican Water Resources Authority. It is a matter of regret to me that we were not permitted to go ahead with this project a year ago. I am glad that you have suggested its reconsideration.

We have given the project no further study since it failed of approval at the authorization hearing last year, but in view of your letter we will review the project. Since such a review will necessarily involve not only the questions you have raised, but also ascertaining the conditions under which the water resources authority may be willing to proceed with a plant, it may not be possible to provide you with our views by the time of the authorization hearings. You may be assured, however, that you will be advised as promptly as possible.

Sincerely yours,

LEWIS L. STRAUSS, *Chairman.*

Representative HOLIFIELD. So you are not ready at this time to propose any type of a small reactor in this general size category which could be utilized for the Puerto Rican experiment?

Mr. VANCE. No, sir; we are not.

Representative HOLIFIELD. Mr. Ramey.

Mr. RAMEY. What is the status of the design studies that the Commission had originally proposed on an advanced pressurized water reactor and boiling-water reactor of large size? It is our understanding that these design projects were submitted to the Budget Bureau and were knocked out. Is that correct?

Mr. BURROWS. This was part of our original proposal to the Bureau of $4 million for that purpose. In the negotiations on relative priorities this was dropped out.

Representative HOLIFIELD. The committee will consider placing that back in the budget.

We notice another item that was eliminated, the construction of a plutonium production dual-purpose reactor which called for between $100 million and $200 million. As we understand it, the Commission recommended that this be done because of the need for plutonium. We understand that the Budget Bureau did not coincide with your thoughts in that matter, is that right?

Mr. VANCE. That is right.

Representative HOLIFIELD. And they asked that it be eliminated. We have already talked about the $8 million that you are asking for the heavy water test reactor.

As I understand, that was substituted for a $50 million to $60 million reactor which was recommended.

Mr. VANCE. That is not correct. That was in the program we informally discussed with the committee, but the determination that we were not ready in fiscal 1959 to go ahead with construction of the full-scale reactor was made quite independent of the Bureau of the Budget.

In other words, it was made before.

Representative HOLIFIELD. That was a Commission decision?

Mr. VANCE. That was a Commission decision. The Bureau had nothing to do with that.

Mr. DAVIS. Mr. Holifield, the original idea was to build both the heavy water components test reactor and the heavy water power reactor. It was not a case of substituting the heavy water components

test reactor for the other. The heavy water components test reactor is needed in either case.

Representative HOLIFIELD. We have already covered the elimination of $35 million for materials and engineering test reactor. That was a Budget Bureau elimination, was it not?

Mr. BURROWS. This was not exactly an elimination, sir. We went in originally for $35 million on an alternative basis, either to build such a reactor or to have authority to contract for space with the same money.

Representative HOLIFIELD. This is the money where the $27.5 million for contracting was recommended, rather than the $35 million to build?

Mr. BURROWS. It was actually $15 million for test reactor space rather than $27 million.

Representative HOLIFIELD. We had a figure of $27.5 million given this morning.

Mr. BURROWS. That amount includes funds for space in power reactors. It is a total of $27.5 million for all types of testing space. The $15 million is for the space in test reactors as such. Have I made that clear?

Representative HOLIFIELD. Not exactly.

Let me see if I understand. $15 million which you have in the budget request is for contracting to do the kind of work that you would have done in the test reactor which you would have required $35 million for.

Mr. BURROWS. Yes, sir, and in addition there is an additional $12.5 million for the purpose of contracting to put fuel elements in power reactors.

Representative HOLIFIELD. Fuel elements in power reactors?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. What kind of power reactors are you talking about?

Mr. BURROWS. These would be either existing or planned power reactors. The point here would be to put in large batches of fuel elements to test them en masse.

Representative HOLIFIELD. To test them out en masse in the private power reactors?

Mr. BURROWS. In private power reactors.

Representative HOLIFIELD. Is this another method of subsidizing private power reactors?

Mr. VANCE. I would like to explain this item, Mr. Holifield. Admiral Rickover urgently recommended that in our 1959 budget we make provision for the installation of test equipment in other pressurized water reactors such as Yankee, for example, in order that we might test out advance core designs in them. His point was that we had a number of pressurized water reactors in building and although they were designed primarily for power and consequently had no test equipment in them, that it was a relatively simple thing to install the test equipment in addition to producing power, and we could get a lot of valuable information which would help us to improve fuel elements if that test equipment were installed. That is the reason for this item.

Representative HOLIFIELD. Would this $12.5 million be spent in the fabrication of special types of fuel elements and in the installation

of those fuel elements in these privately owned power reactors, or would it be spent in contracting for space to make these tests?

Mr. DAVIS. This would be to pay for any extra cost over and above the normal cost of operation which would be brought about by the instrumentation of cores, charging and discharging specially instrumented cores or special batches of fuel elements, taking them out and examining them in hot cells, and going through the process of testing out multiton batches of new and advanced types of fuel elements in existing power reactors.

It would be the extra cost of doing this.

Representative HOLIFIELD. Wouldn't this be a detriment? Let us take the Yankee people, for instance. If they were depending on a continuous source of power and they were interrupted with this type of testing, wouldn't this penalize their efficiency?

Mr. DAVIS. It might penalize it some. They might have to operate in some particular way for a period of time to get the test results. They might have to do things of this sort; yes, sir.

Representative HOLIFIELD. They would get the benefit of the heat that would be generated as a result of using these fuel rods, would they not?

Mr. DAVIS. Yes, sir.

Representative HOLIFIELD. Would that be taken into consideration in the setting up of grants to them from this sum?

Mr. DAVIS. We had planned to take account of the value of the heat generated in determining what the actual extra costs were.

Representative HOLIFIELD. The next item that we have on the list was the small-plant reactors for the Defense Department, an item of $35 million. That was stricken, was it not?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. There is something like $3 million left.

Mr. BURROWS. Yes, sir. We have covered this in executive session. Do you want to cover it again?

Representative HOLIFIELD. We are just going down the line on this for the public record right now. This has been taken out, has it not, by the Bureau of the Budget?

Mr. BURROWS. We agreed to this deletion. This was not taken out. This got to a question of firm requirements and whether we would fund it or the Defense Department would fund it based upon whether this was an applied use of a well-developed reactor rather than a developmental reactor.

Chairman DURHAM. Have you got it in the construction act before the other committee now?

Mr. BURROWS. I don't think so. This is part of the problem. The requirement had not been fully firmed up.

Representative HOLIFIELD. Item *f* is the elimination of a tanker propulsion plant, for a decrease of $7 million. As I understand, these items would be funded by either the Department of Defense or the Maritime Administration, either the $35 million in the case of the Department of Defense and the $7 million in the case of the Maritime Administration. If those projects are carried forward, it will depend upon funding from those two agencies.

Mr. BURROWS. That is correct, sir.

Representative HOLIFIELD. Now, your next item was the elimination of the metals process development plant at Ames, Iowa, for a decrease

of $1.9 million. Was there some thought that that could be done by private industry?

Mr. BURROWS. No, sir.

Representative HOLIFIELD. So, what does the elimination of that item mean? Does it mean a gap in the program or a slowdown on the program or what does it mean?

Mr. BURROWS. This was an item which was considered to be desirable but not absolutely necessary on our priority list. It would have provided better and more space at Ames.

Mr. RAMEY. This is Dr. Spedding's development building?

Mr. BURROWS. That is correct, sir.

Representative HOLIFIELD. We have something like $30 million for general research and development, I believe, and this is not thought important enough to be included in the regular research and development money that you have asked for. This has been eliminated?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. Is there anything more important right now than finding out how to process metals, or was this for a plant to process metals?

Mr. BURROWS. This was for a plant.

Representative HOLIFIELD. This was for a building?

Mr. BURROWS. Yes, sir.

Representative HOLIFIELD. Ostensibly, you will either not carry forward that particular project——

Mr. BURROWS. It will mean that the work will have to be carried on in the present facilities.

Representative HOLIFIELD. In the present facilities, or lost because of the lack of a plant to conduct those experiments in?

Mr. BURROWS. This has been carried on in other buildings. How much would be lost by reason of not having a new facility, I cannot testify to, sir.

Representative HOLIFIELD. You ought to be able to tell us, if you asked for a couple of million dollars to build a plant. You ought to know whether you needed it or not and whether it would increase or decrease your program.

Mr. BURROWS. This was an item which we considered to be desirable and which would be an improvement, but one that is not absolutely necessary for the conduct of the program, as I understand it.

Mr. FLOBERG. Maybe I can clarify this just a little bit.

This facility was adjudged by us to be able to make some contribution to some of the metallurgy problems in connection with the ANP program. We thought it might help us accelerate that program in certain areas. This group of people out there had been quite successful in making contributions to this program before, and some of the basic developments have been the result of their work.

It was our plan that we could accelerate and improve their work with this facility. The facility is not now in the program. So, we will have to figure out some other way to get this work done.

Representative HOLIFIELD. The facility is not in the program now, and the program itself has been slowed down, the ANP program. Does that have any effect on your need for this?

Mr. FLOBERG. That was not the sequence. The idea was that the availability of this facility would help us to speed up some of the basic technological and scientific work in the program. This was not

dropped out because the program was slowed down. The reverse may be the consequence.

Mr. DAVIS. The kind of work they would do in this facility would contribute to other programs. They have helped Detroit Edison in the sodium metal cooled reactor work and that sort of work. It is a very competent group, and they have made many substantial and broad contributions to the program.

Representative HOLIFIELD. Are they going to be kept busy, or will we lose them?

Mr. FLOBERG. They will be kept busy, but this would be an incremental increase in their capability to contribute to these programs.

Representative HOLIFIELD. The last item on this list was the $6½ million metals and ceramics research building at Oak Ridge. That was eliminated, $6½ million, by the Budget Bureau. Are we to understand that this program will proceed in the old buildings at Oak Ridge and, if so, will it be at a reduced rate, or was this to give you an incremental capacity in your research at Oak Ridge?

Mr. DAVIS. Part of the building would have been used for work in the reactor development area. Actually, the work is being conducted, and conducted quite well, in a series of old buildings down there. This, I believe, would have given them some additional space and a small amount of additional capacity. But, primarily, it would have consolidated the research and development work and provided them with better facilities to carry it out in.

Chairman DURHAM. Is private enterprise doing any of this work?

Mr. DAVIS. You mean the metallurgy and ceramic work?

Chairman DURHAM. Yes.

Mr. DAVIS. Quite a bit of work of this type is being done by the various industrial contractors and, to some extent, by people with their own money. I do not believe anyone is doing it on the scale that it is being done by the Oak Ridge National Laboratory at the present time.

Chairman DURHAM. It is quite important don't you think so?

Mr. DAVIS. The fuel-element work and materials work, certainly, is the key to the reactor program; yes, sir.

Chairman DURHAM. It goes even beyond the fuel-element work, does it not? It goes into the high-temperature field, to a large extent.

Mr. DAVIS. This work in the ceramic materials and fuels is mostly in the high temperature area, yes.

Mr. RAMEY. With respect to the Commission's submission of their information on their 1959 operating budget, it shows in one line a breakdown on the civilian power reactor program, the ship program, and then it covers 1958, and then for 1959 the base program and the supplemental program and the total.

It shows on your total for 1958, $110 million. Then for 1959 it shows a total for the base program of $115 million, and then on the supplemental program it adds $23 million to make a total of $138 million.

I gather from your statement that the main increase is $15 million in your supporting programs, particularly on the fuel cycle development and separation system. One question that you might provide for the record is, How much did you go into the Bureau of the Budget for? How much did you ask for each of these categories?

Mr. BURROWS. For each of the categories?

Mr. RAMEY. Yes.

Representative HOLIFIELD. Those can be furnished later. You do not need to furnish them now.

Mr. RAMEY. Perhaps you can give the totals.

Representative HOLIFIELD. If you have the totals ready for us, give them. Otherwise, furnish them to us.

Mr. BURROWS. I would rather furnish both the totals and the details for the record, sir, if I might.

(The information referred to follows:)

U. S. Atomic Energy Commission—Comparison of Bureau of the Budget allowance with amounts requested in fiscal year 1959 budget amendment, operating expenses

[In millions]

Item	Amount requested	Amount allowed
Special nuclear materials (costs)	$2.2	0
Weapons:		
Military costs	28.5	$13.6
Nonmilitary costs	2.4	1.4
Related obligations	14.1	7.0
Total, weapons	45.0	22.0
Reactor development:		
Civilian power:		
Government program:		
Costs	18.5	11.6
Related obligations	7.5	3.5
Total, Government program	26.0	15.1
Cooperative arrangements: Obligations	20.0	0
Fuel-cycle program:		
Costs	15.0	15.0
Obligations:		
Space in power reactors	25.0	12.5
Space in test reactors	0	[1] 15.0
Total, fuel cycle	40.0	42.5
Euratom program	10.0	0
Nuclear merchant tanker:		
Costs	1.0	.7
Related obligations	3.0	.3
Total, nuclear merchant tanker	4.0	1.0
Army:		
Costs	6.0	3.0
Related obligations	5.0	.3
Total, Army	11.0	3.3
Navy:		
Costs	10.0	4.4
Related obligations	3.5	1.4
Total, Navy	13.5	5.8
ANP:		
Costs	5.0	3.0
Related obligations	2.0	0
Total, ANP	7.0	3.0
Rover:		
Costs	6.0	6.0
Related obligations	2.0	2.0
Total, Rover	8.0	8.0

[1] Allowed in lieu of $35,000,000 requested for construction of test reactors.

U. S. Atomic Energy Commission—Comparison of Bureau of the Budget allowance with amounts requested in fiscal year 1959 budget amendment, operating expenses—Continued

[In millions]

Item	Amount requested	Amount allowed
Reactor development—Con.		
Pluto:		
Costs	$3.0	$3.0
Related obligations	1.0	0
Total, Pluto	4.0	3.0
Snap	2.0	2.0
Other reactor:		
Costs	11.0	2.7
Related obligations	3.0	.5
Total, other	14.0	3.2
Total, reactor development (excluding Sherwood)	159.5	86.9
Sherwood:		
Costs	10.8	3.0
Related obligations	11.2	8.2
Total, Sherwood	22.0	11.2
Physical research:		
Costs	20.0	18.5
Related obligations	6.0	3.4
Total, physical research	26.0	21.9
Grand total	254.7	142.0

Representative HOLIFIELD. Very well.

Mr. Graham, you may proceed.

Mr. GRAHAM. Thank you, sir.

Fiscal year 1960: Item 11: Construction of a heavy-water-moderated power reactor may be initiated if design evaluation and preliminary design performed in fiscal year 1959 show favorable results. A necessary feature of this project is demonstration of operability on natural uranium fuel, and the plant size should be the minimum to make this possible. It is estimated that this is of the order of 100 EMW.

Item 12: Additional research and development on a single-region aqueous homogeneous reactor will be carried out and construction of such a reactor in large scale may be initiated. The true assessment of operating and maintenance problems of reactors having highly radioactive circulating fluid fuel can be made best from actual experience with a large plant. It is currently assumed that this will be done as a cooperative project with Pennsylvania Power & Light and Westinghouse.

Representative HOLIFIELD. Will the $7 million which is requested for the Pennsylvania Power & Light go toward this work?

Mr. GRAHAM. This is the research only.

Representative HOLIFIELD. That is what I mean, research and development.

Mr. VANCE. Yes, but no construction.

Representative HOLIFIELD. You may proceed.

Mr. GRAHAM. Item 13: Design of an intermediate sized two-region aqueous homogeneous reactor experiment may be initiated. It is visualized that the size and design of the plant should permit actual demonstration of breeding on the thorium U–233 cycle. The possibility of breeding on this fuel cycle with a relatively short doubling time, 10 years, is one of the chief attractions of aqueous homogeneous reactors.

Representative HOLIFIELD. This is the experiment that we had trouble with down at Oak Ridge, is it not?

Mr. GRAHAM. Yes, this is the Oak Ridge type.

Representative HOLIFIELD. Was this written before that trouble down there or since then?

Mr. GRAHAM. I believe it has been since that, but I will have to check.

Representative HOLIFIELD. In other words, are we to take this now as a judgment of the committee that you are going to go ahead on this now, notwithstanding the trouble down there?

Mr. DAVIS. This was really written before we had the most recent trouble down there. We are still completely undecided, I would say, as to just what ought to be the next step. I think the thinking of the laboratory is that possibly the next step should be another small-scale experiment rather than the intermediate one listed here. This has not reached any decision and we are still having conversations with them.

Representative HOLIFIELD. So this is at the present time, very tentative?

Mr. DAVIS. Yes. I think the only thing we can say here is that we think we probably would want to go ahead with some kind of additional reactor experiment but we cannot tell now what type and size it should be.

Representative HOLIFIELD. Your main trouble was on your erosion down there, was it not?

Mr. DAVIS. No. The most recent trouble was apparently a crack in the zirconium core tank. I believe that the best guess is that this was probably due to thermal stress and probably was not due to corrosion. I have to emphasize that we cannot get to it and we cannot really tell yet, what actually did cause it.

Representative HOLIFIELD. Proceed, Mr. Graham.

Mr. GRAHAM. Thank you, sir.

Item 14. Construction of a small-scale pressurized water reactor based on best available technology may be desirable to provide a better basis for comparison with boiling water technology in small-scale plants. A design power level of 20–40 EMW is visualized. Cooperation with the military in such a plant should be explored if the Department of Defense has a requirement in this area.

Representative HOLIFIELD. Is it your thought that one of this size and type at this time would be very expensive? That is, the kilowatts would be quite expensive, would they not, much more so than the Shippingport for instance?

This is about from one-third to one-half the size of Shippingport. Would you anticipate at this time—maybe I should direct this to Mr. Davis—that this size plant would cost you too much in terms of kilowatts?

Mr. DAVIS. It would certainly cost too much in this size range to be economic in the United States, but we feel that for remote locations where the transport of fuel is a problem that it may actually be very nearly economical considering all of the cost.

Representative HOLIFIELD. Probably for military use and not civilian use?

Mr. DAVIS. That is correct.

Mr. VANCE. On the DEW line, for example.

Mr. DAVIS. We would not estimate the cost as high as Shippingport in any case.

Representative HOLIFIELD. You may proceed, Mr. Graham.

Mr. GRAHAM. Item 15: Major modifications to the core of the SRE may be made as a pilot to elimination of moderator cans. Consideration also should be given to design for operation with an intermediate neutron energy spectrum. It may become desirable to initiate design of an SRE–II if limitation to SRE time and flexibility forecast program delays.

Senator GORE. Before you leave that page, will you explain a little further the last sentence in item 13? This strikes me as being quite significant. A so-called fast breeder reactor is now planned at Laguna Beach. This indicates that a two-region aqueous reactor just might offer possibilities of more effective and faster breeding than the so-called fast breeder reactor now under construction.

Mr. GRAHAM. May I ask Dr. Davis to address himself to this?

Mr. DAVIS. Senator Gore, this is true. What we call the breeding ratio, which is the amount of fuel material made per unit amount burned up, is higher in the fast breeder reactor. It may be 40 or 50 percent more in case of the fast breeder and something like 10 percent more per trip around so to speak, in the aqueous homogeneous as compared to a fast breeder reactor.

In the fast reactor you have quite a lot of inventory of fuel material and in aqueous you have a small inventory so the fuel tends to cycle more rapidly.

This is like taking a 10 percent interest every year versus taking 40 percent every 10 years.

Senator GORE. I have never been on the taking end of that. If you will turn it around, I will understand it better.

Mr. DAVIS. In other words, the rate of interest is higher in the fast breeder but you do not get it anywhere near as often. For this reason, if you start out with a given amount of fissionable material in an aqueous homogeneous reactor you may be able to get twice as much in a shorter period of time than if you start out with the same amount of material in a fast breeder.

There is a distinction, which is not made here, which is extremely important and that is that the fast breeder is the only way that we know of breeding to go with uranium and plutonium and convert all of the uranium to plutonium and the plutonium to fission products and heat.

The aqueous homogeneous is probably not the only way, but probably the best way of converting thorium to U–233 and the U–233 to fission products and heat.

You cannot compare one as a substitute for the other because they operate on an entirely different fuel cycle. You have to have both

of them if you want to use up all of the thorium and all of the uranium. The aqueous homogeneous reactor will work only with the thorium cycle and the fast breeder only with the plutonium cycle.

Senator GORE. As you know, because we have talked about this before, I have watched the development of this reactor concept closely and have been laying some Coca Cola bets on it emerging as one of the most promising concepts.

Like you, I have been disappointed at some of the difficulties, but does it not now in fact, emerge as one of the most promising reactor concepts with which we have had substantial experience?

Mr. DAVIS. Senator, I would say that I do not regard the difficulties that we have had with it at Oak Ridge as decreasing our interest in it or making us feel it is any less advantageous as a reactor. I do think because of the difficulties we have not made technical progress with it as fast as we might have otherwise.

I think we all feel it is still a very promising, advanced type of reactor, but it is one which is still some years off as far as producing economic power.

Senator GORE. I am not sure I could agree with you that it is some years off unless there is some definition of "some." Of course, it takes some years to build it. I have the feeling that maybe we are nearer to the point of actual power-scale size construction than some people may think. I notice in your exhibit on the last page, or is it the last page——

Mr. DAVIS. Next to the last page.

Senator GORE. Yes. I am puzzled that you show in this projected homogeneous breeder reactor a 70-thermal megawatt energy production, but you show zero electrical production. I would hope that as this develops we could combine the experimental with the practical and actually convert this energy to power.

Also I should think that Oak Ridge would be the logical place to locate it since the laboratory is there and the experimental station is there, though I would support it regardless of location.

Mr. DAVIS. Senator, just before you came in we covered this item and pointed out that this particular section had been written before the recent difficulties with the reactor at Oak Ridge.

Although we have been discussing this work with Oak Ridge and although we had not come to any conclusions yet, our feeling was that the next step would probably be another small-scale reactor rather than the intermediate one that is discussed here.

Senator GORE. Instead of an intermediate size, if you constructed a small-scale reactor, it would be of the order of 5,000 to 10,000 kilowatts?

Mr. DAVIS. Probably 3,000 to 5,000 thermal kilowatts.

Senator GORE. Would it still be your view that the energy not be converted?

Mr. DAVIS. I think in this type of reactor in contrast to some of the others, there is no very great practical incentive to try to hook up a turbogenerator. One of the reasons that we have done this in the reactor experiment such as the EBWR, is that there has been a very real problem about the connection of a turbine with an actual operating reactor.

In the case of the homogeneous reactor, their unique characteristics mean there is virtually no problem in this regard so one does not

have the same desire from a technical point of view, to hook a turbine on such a reactor.

Actually, the HRE–I and HRE–II have a very small secondhand turbine which is connected to them which makes, I believe, something like 160 total electrical kilowatts, but this has not proven to be a particularly useful thing and I do not believe they even try to operate it.

Senator GORE. Will you explain how the region 2 and region 1 technology differ? I noticed Edison Institute lists the possibility of 75 to 150 megawatts by an aqueous homogeneous concept process.

Mr. DAVIS. The difference between a single region and a dual region?

Senator GORE. Yes. Does that involve the fast breeder fuel cycling?

Mr. DAVIS. Actually, there are two different ways you can have the fuel material in what we have called an aqueous homogeneous reactor. One of them is a salt of uranium dissolved in water which is a true solution.

The other way is as a slurry of fine particles which are simply carried by the motion of the water. You are dealing with a slurry or suspension of solid particles in water. If one tried to go to a complete solution-type reactor which is single region, one would find that the concentration required of the salts, except for the reactor that is impractically large to build, would be such that you could not get a useful power reactor. You would have very great difficulty of corrosion because of the high concentration. When you divide this up into two regions with a central highly enriched core and an outer blanket region, you can improve the conversion or breeding ratio, so that this is believed by Oak Ridge to be the optimum type; where you have either a solution or a slurry inside a core tank with the highly enriched material and surrounding that a blanket of thorium suspended in water.

We do not know any practical way to dissolve the thorium in a solution. One has to treat it as a slurry. It is easier, however, to build a single region slurry reactor which has the enriched material and fertile material mixed together. It will not have as high a conversion ratio.

The Pennsylvania Power & Light reactor is a single-region reactor which is all slurry. It does not have the corrosion problems in the core solution. It does not have the problems in the core liner which is the thing that failed in HRE–2.

Oak Ridge, on the other hand, is pursuing the breeder type of concept which will have a higher conversion ratio, but when they go to this they have to have two regions. The problem is in the core tank. If they try to make the central region a solution, they get into the corrosion problems as well.

So the technical difficulties of trying to get this high breeding ratio are greater than if you would settle for a single-region reactor. The advantage is the breeding ratio that you are talking about.

Senator GORE. I will want, Mr. Chairman, to suggest at the proper time that technicians in charge of the experimental reactor at Oak Ridge be invited to testify before the committee.

This, it appears to me, is a most promising concept and perhaps the committee would want to consider authorization for an intermediate-size reactor of this type to give it the spur and encouragement that might prove very beneficial.

Mr. RAMEY. Senator, in that connection we have discussed for a couple of years now that if we continue these small-scale tests and then run into these somewhat extraneous technical difficulties that it may be decided that the homogeneous reactor concept is not feasible without having built a reactor of any size.

Senator GORE. Again we learn by doing. I would like to see this one developed along with the gas cooled and other types of reactors.

Mr. DAVIS. Senator, I do not believe that Oak Ridge feels that they would be in any position to start building a large-scale homogeneous reactor now.

Senator GORE. I was not implying that they would thus feel that way, but I think the committee will want to be informed of the attitudes and experience of the technicians there.

Representative HOLIFIELD. You may proceed, Mr. Graham.

Mr. GRAHAM. Thank you, sir.

Item 16: Construction of a second organic moderated reactor experiment may be initiated. This reactor is visualized as a pilot to large-scale plant and should be designed with special attention to improved geometry for reduction of radiation effects on the organics and flexibility for component testing. Design of a large-scale plant would be helpful as a guide to the need for and the design of the smaller pilot plant.

Mr. RAMEY. The question there would be whether or not it would be desirable, in view of the apparent success you are having with your present OMRE experiment and your possible modifications of it—why not go the next step instead of going to a pilot plant? Why not go to an experimental prototype in the intermediate range of, say, 50 electrical megawatts?

Mr. DAVIS. I think our feeling here is that there is still a great deal that we may learn about improved types of organic moderated reactors. We are quite sure that the organic will prove to be a useful material as a coolant. It may be possible to use other materials as moderators so as to cut down the amount of organic which has to be replaced.

I think it should be said very strongly that the organic moderated reactor experiment is simply a feasibility experiment to test out the effects of irradiation on organics under reactor conditions. The reactor was designed specifically to give the organic materials the greatest possible degree of radiation damage. We have not built any reactors and do not have any plan where we have tried to minimize the damage.

Once it has been shown that they can sustain the radiation effects to an acceptable degree, then there are quite a number of possibilities which ought to be explored for reactors which would make the best use of this property.

I do not think this is commonly realized, that we have designed the OMRE, not to give minimum damage to the organic, but maximum damage. As such, it is not an experiment where we can go directly to a next stage reactor.

Mr. RAMEY. We have had a good deal of boldness in some cases of jumping from an experiment to large-scale plant, but here we seem to want to go each little step of the way, whereas, the North American people, for example, who are handling the organic work, are making

proposals on building large-scale plants abroad. You may have a large-scale plant built before you get your next pilot plant built.

Mr. DAVIS. I would like to observe that the OMRE is quite comparable to the first of the BORAX experiments. We have learned a great deal by building the EBWR in addition to having had the BORAX experiments. A great deal can be learned.

This does not mean that you cannot take the technology as it exists at any one level and proceed from that to build a useful intermediate or large size reactor. You still need the smaller scale reactor experiment to try out new things.

The only intent of this item in here is to represent the possibility that we might want to try to exploit the organic moderated reactor in some other direction. This does not preclude doing other things as well.

Mr. RAMEY. So if the program were further accelerated, then you would not necessarily be opposed to building an intermediate sized organic prototype?

Mr. DAVIS. I think it is quite likely we would want to build this regardless of what else was done. This was the point.

Representative HOLIFIELD. Proceed, Mr. Graham.

Mr. GRAHAM. Item 17: Construction may be initiated on a prototype nuclear powerplant using a reactor which is moderated with heavy water and cooled with high temperature gas. The design is visualized as of the pressure tube type.

In large sizes, this type plant may be suitable for use of natural uranium fuel. The prototype plant would assist in the evaluation of this system with natural or partially enriched fuel. It is currently assumed that this will be done as a cooperative project with ECNG and FWCNG.

18. Construction of a prototype heavy water moderated and cooled nuclear powerplant may be initiated. This plant should be based on design optimization for minimum cost nuclear power from this concept in the United States, including most effective use of partially enriched fuel. It is currently assumed that this will be done as a cooperative project with CVNPG.

Item 19: Construction of a heavy water moderated, sodium cooled experimental powerplant may be initiated. It is currently assumed that this will be done as a cooperative project with Chugach. While current plans are to build the small-scale reactor as part of a powerplant on a utility system, the long-range interest in this concept relates to the possibility of high thermal efficiencies and low nuclear power costs in large scale plants which may be operable on natural uranium.

Item 20: Construction of a reactor experiment of intermediate size utilizing molten salt as fuel may be initiated if additional work shows this concept to be attractive.

Item 21: Construction of a low temperature process heat prototype plant may be initiated. This may be a more promising or more extensive application of nuclear energy than production of electricity.

Representative HOLIFIELD. Mr. Ramey?

Mr. RAMEY. If the program were to be accelerated, would it not make sense to start design on such a plant as this in fiscal 1959?

Mr. GRAHAM. This is the process heat matter that I believe Dr. Davis spoke to earlier this morning. Would you like to comment on that, sir?

Mr. DAVIS. I do not believe here, it is too much a problem of the design. The process heat reactor, particularly one designed to produce relatively low pressure and temperature steam which is one of the more interesting early applications, is not a unique or particularly novel design problem.

The real problem is to find some place where such a reactor can be built and utilized effectively under conditions where it is economic.

Mr. RAMEY. Haven't there been proposals? We keep hearing about people wanting to do something along this line and wanting to get a little Government help, but we have asked questions about this for a couple of years now.

Mr. DAVIS. We have anticipated proposals and I still think we may get one, Mr. Ramey, but we have not so far.

Mr. RAMEY. From the design standpoint, if you were to start designing one in 1959, you would be that much ahead. It takes time to design.

Mr. DAVIS. One of the problems here is that you have to know what the temperature and pressure of steam that is required for processing. This is a fairly critical item. The other one is that the real difficulty so far in the use of such a reactor for process heating is the fact that the need for process heat at any one place is relatively small. People are usually talking of reactors of the equivalent of 30 or 40 electrical megawatts and one has the same cost problem that one has with a smaller pressurized boiling water reactor.

It will require a unique set of circumstances before you know exactly what might be done.

Representative HOLIFIELD. Are you telling us that there is a limited field for process heat?

Mr. DAVIS. Not that there is a limited need, but the need in one place for large amounts is not very great. You cannot transmit steam in the same way you do electricity so the reactor and the use of it have to be tied together.

One cannot make process steam somewhere and use it somewhere else. They have to be very close to each other. The amount normally which is utilized at any one place, even though it may be a couple of hundred thousand pounds of steam, is still a relatively small amount compared with a steam generating plant for producing electricity.

Mr. RAMEY. What would a plant like this cost?

Mr. DAVIS. It would depend entirely on its size and also on the temperatures that were required.

Mr. RAMEY. Wouldn't this be the kind of a project that you might designate during 1959 and ask for industrial proposals to specifically build and get on with it?

Mr. DAVIS. I think you might encourage it. I think the difficulty is that if you did not get any proposals you would not have any place to use it. This is not the kind of thing where we could use the steam. You have to have a place to use it right there.

You are not dealing with something that can be transmitted somewhere or is used generally such as electric power.

Mr. RAMEY. You would know, then, whether industry was interested?

Mr. DAVIS. As I say, I believe that some interest does exist and that we may get some proposals.

Representative HOLIFIELD. This still does not cover Mr. Ramey's point. The point is, is this important enough that the Commission should say definitely that we want a proposal on this and test out the market to find out if you could get a proposal?

That is what I think he is driving at, whether we are going to leave this in the realm of speculation or whether it is important enough to actually put it to the test in the market place as to industry's interest. Not that the Government needs to go ahead and do something on it if there is no industry interest in it. We might be foolish to go ahead.

Mr. DAVIS. I think the industrial people do know we are interested in this. I do not think we would need to make too specific a point of it. I think my point here was that if no one was interested, I do not think it is the kind of reactor that we would build, because then we would not have any place to use it ourselves, in all probability.

Representative HOLIFIELD. This may be true. I would not say that if they were not interested that you should go ahead. Do you not think that it is part of the obligation of the Commission to test these types in general and find out where the interest lies? The Piqua plant, we heard about that originally as being a process steam plant, did we not?

Mr. DAVIS. They have some use for it.

Representative HOLIFIELD. For industries in their area. I do not know what they are, pulpwood or newspaper making or whatever it is. I do not know.

Mr. DAVIS. I might say, Mr. Holifield, we have had studies conducted by various people of the need for process heat reactors and we have had some people looking at this. We have been trying to evaluate what the market is ourselves and to arrive at some idea as to where and how we can stir up some interest in this.

Representative HOLIFIELD. The committee has had some contacts along this line of people who claim an interest and yet, they more or less put the monkey on the back of the Commission by saying that when they talk to the Commission the Commission shows no interest in it.

We are not in a position to evaluate those complaints. Anyway, this is one of the reasons why Mr. Ramey is asking these questions.

Mr. DAVIS. We do know that there are some companies who are actively trying to find someone to utilize the steam from a process heat reactor and make a proposal. This we are quite aware of. I would say generally, we have encouraged them.

Mr. RAMEY. If it were put the other way, again, instead of waiting for a proposal, for the Commission to say, "We think it is important to develop a process steam reactor; we want proposals from industry and we will be able to put up so much money to do it," would you not be more likely to get proposals and actually canvass them or even call a seminar on process steam reactors?

Mr. DAVIS. I would agree with you that we might be able to do more to stir up some interest, but I do not think we would really be likely to get any more proposals than we are likely to get anyhow because I think our interest is pretty generally known by the people who are interested in this type of reactor.

Mr. FLOBERG. I made an effort on a personal basis to stimulate some interest and I must say my efforts have been unproductive and that is why I chilled on it. I would like to know who the people are who expressed an interest.

Representative HOLIFIELD. We will furnish those names. It might be that we could act as an intermediary here.

Go ahead with the next item.

Mr. VANCE. Mr. Floberg.

Mr. FLOBERG. Fiscal year 1961—fiscal year 1962—fiscal year 1963; Item 22: Projections of potentially desirable new reactor projects become increasingly difficult as the projection reaches further into the future. Prospects for the period of fiscal year 1961 through fiscal year 1963 perhaps can be discussed best in terms of desirable developments within major reactor classes.

Item 23. Water moderated and cooled reactors (heterogeneous): Continued design improvements, development results, and operating experience are expected to provide a basis for initiation of 2 to 4 new large-scale projects for boiling and nonboiling power reactors during this period. In addition, it may prove desirable to initiate one or two small power reactors of this class.

One of the economic handicaps of current water cooled reactors is the relatively poor quality of the steam which is produced by them. It is believed possible that some of these plants could incorporate nuclear superheat, and that this will prove to be economically desirable.

This possibility depends upon successful research and development on fuel materials. Several different mechanical design arrangements appear feasible if the fuel problem can be solved.

Item 24. Sodium cooled, graphite moderated: Experience with SRE–I and the large-scale plant at Hallam, Nebr., should provide a basis for confidence in operating reliability of large sodium systems. If operating experience is favorable, design of a second generation large-scale, sodium graphite plant should then be initiated during this period.

The direction of research, development and design for improved, lower cost, sodium graphite plants should be toward improved neutron economy and higher thermal efficiency. It is possible that construction of an SRE–II will be needed in addition to modifications in the present SRE in order to explore advanced designs, including those operating on neutrons of intermediate energy.

Item 25. Fast breeder reactors: Operating experience with EBR–II and possibly the large-scale Enrico Fermi plant if the operating license is issued should provide a basis for initiation of a second generation large-scale fast breeder reactor. It may also be desirable to initiate construction of an EBR–III designed to explore, on a small scale, a core operating on fast neutrons coupled to a second region operating on thermal neutrons.

Item 26. Organic cooled reactors: Organic materials have promise in both small-scale and large-scale plants. If this promise is sustained by continued development, additional projects may be initiated during this period.

In the case of any large-scale plant, it may prove advantageous to use the organic as the coolant with another material, such as graphite or heavy water, as moderator.

Representative HOLIFIELD. Let us go back for a minute to the fast breeder reactor, Mr. Davis. What is the status of the Laguna Beach plant at the present time?

Mr. DAVIS. It is under construction at the present time.

Representative HOLIFIELD. What is under construction? Are the buildings constructed, the containment sphere?

Mr. DAVIS. The containment vessel has been erected, that is the outer one, the inner reactor tank has been installed. I believe they have quite a bit of the other equipment either on hand or due shortly and will be available to put the plant together and to run it as a hot test facility sometime in a year or so from now, I believe.

Representative HOLIFIELD. They are proceeding pretty well on the technology of the EBR–II?

Mr. DAVIS. They are developing a great deal of technology themselves. Their fuel elements are slightly different from the EBR–II fuel elements and their design has several fairly substantial differences from EBR–II.

Representative HOLIFIELD. Are you proceeding with additional research and development in this field? I think there is some $30 million that has been made available in this field for the Commission to utilize in its own laboratories; is that going ahead?

Mr. DAVIS. I am not familiar with the $30 million number, but we are doing a substantial amount of development work on fast breeders at Argonne and at Los Alamos.

Representative HOLIFIELD. In what field are you doing it—in the field of fuel development or metallurgy, or what field?

Mr. DAVIS. The work covers all aspects of the fast breeder program: The fuel materials, the fuel elements, sodium components, control systems, basic physics, all of the components and all of the aspects of fast breeder plants.

Representative HOLIFIELD. Is all this being made available to the plant at Laguna Beach?

Mr. DAVIS. They have access to all the information that is developed by the Commission.

Representative HOLIFIELD. Have they been in the laboratories where these experiments and developments are going on to keep in constant touch with what is going on?

Mr. DAVIS. Yes; they have had people there visting quite regularly. I might also add we have had the EBR–I in operation, as I think you know, and it has been operating very satisfactorily, too.

Representative HOLIFIELD. That was the one that got too hot down at Oak Ridge?

Mr. DAVIS. No; this is at Arco. We have put in a so-called rigidized core and have operated the plant up to 1,000 kilowatts with no evidence whatsoever of either the prompt coefficient or the instabilities that were noticed with the Mark–II core.

Representative HOLIFIELD. Has the design for the cores in the Enrico Fermi plant been settled on yet?

Mr. DAVIS. I believe they have settled on their first core design; yes.

Mr. RAMEY. Have they purchased the core?

Mr. DAVIS. I believe they are placing orders for at least part of it.

Mr. RAMEY. Has there been any increase in cost of that, do you know?

Mr. DAVIS. I cannot speak to that detail.

Mr. RAMEY. Do you suppose we could have that for the record as to what the cost situation is?

Mr. DAVIS. I think we could furnish a current estimate.

(The information referred to follows:)

As of June 9, 1958, the Power Reactor Development Co. had placed on order a letter of intent with Nuclear Metals, Inc., for 1 core loading and one-half of a blanket loading at a total fabrication cost of approximately $1.6 million.

Representative HOLIFIELD. You may proceed, Mr. Floberg.

Mr. FLOBERG. Item 27. Gas cooled reactors: If results of research and development and operating experience with experimental gas-cooled reactors are favorable, additional projects may be initiated during this period.

Item 28. Operation with natural uranium: This period should mark the initiation of operation of the plutonium fuel testing reactor and of a large-scale heavy water moderated reactor operable with natural uranium.

Reactors operable on a natural uranium core and those operable on a natural uranium feed stream with plutonium recycle should be assessable on a more reliable basis. It may be possible during this period to initiate more extensive testing of plutonium fuels in several existing reactor experiments.

Item 29. Liquid metal fueled reactor: If the LMFRE–I is successful in demonstrating technical feasibility of the uranium-bismuth fuel solution for the reactor core, it may be timely to initiate an LMFRE–II which would include use of a slurry in a blanket region, or as a single region reactor.

Item 30. Process heat reactors: Energy consumption for process heat is much greater than for production of electricity. Nuclear energy has promise for supplying process heat requirements over a wide range of temperatures. One or more plants of pilot size or larger may be started during this period to provide a reliable basis for economic evaluation in the low temperature and intermediate temperature ranges.

Research and development on major components, such as fuel, for high temperature process heat plants should be continuing.

Item 31. New concepts: New ideas in reactor design and reactor application will continue to develop. These ideas must be carefully and systematically evaluated. One or more new reactor experiments may be warranted during this period in order to test these new concepts.

Representative HOLIFIELD. Mr. Ramey.

Mr. RAMEY. Going back to the nuclear superheat type of reactor, is research and development going forward on that concept?

Mr. DAVIS. On the nuclear superheat?

Mr. RAMEY. Yes.

Mr. DAVIS. Yes, Argonne is doing work on this and also the Northern States people, as part of their project are making fairly extensive studies of this.

Mr. RAMEY. It is noted that you have that type of concept for the 1961–63 period. Wouldn't it be possible to move that up in your time scale a little bit? We have heard a good deal about the desirability of this concept of superheat and getting it into your 1959–60 period might be desirable.

Mr. DAVIS. This is a problem of time.

Here again I have to make somewhat the same speech I have before and that is that you are talking here about developing materials that will stand superheated steam in a high temperature reactor for extended periods of time.

Although we think that these problems can be solved one can't tell by testing something for 6 months whether it is going to last for 20 or 25 years. We are really just getting started on this now. I think it is going to take us some period of time before we have confidence that we have the materials that are needed for superheating.

Mr. RAMEY. Does the Commission plan to develop a steam-cooled reactor concept which could possibly be used in connection with other reactor types such as a boiling reactor and take the steam off it?

Mr. DAVIS. This is the nuclear superheat.

Mr. RAMEY. Is this the heart of your whole superheat concept?

Mr. DAVIS. Yes. You can do it with nuclear superheat either as a special section in a single reactor, where you utilize the fuel material in the superheating section to provide a part of the critical mass in the reactor, or you can build an entirely separate reactor that takes the steam from the first reactor or the steam generated by the heat in the first reactor and passes it through a separate reactor where it is superheated. But we regard the nuclear superheat problem as encompassing both of these possible arrangements for doing this.

Representative HOLIFIELD. Does the Florida project plan to use this system of nuclear superheat?

Mr. DAVIS. In the case of the Florida project where they would be using a gas cooling, they would simply superheat with the high temperature gas. They would not need to pass the steam back through a reactor in order to superheat it. The same is generally true of the sodium-cooled reactors.

Mr. RAMEY. It is noted that in the Edison Institute list of desirable reactor projects they had a Hanford type reactor, graphite-moderated, normal water-cooled, as a desirable type of reactor. In Dr. Zinn's report to the Joint Committee 2 years ago it was similarly in there as a power reactor concept. I take it the Commission also had that in their program to some extent in connection with the dual purpose reactor as a concept that might appropriately be furthered.

Is that correct?

Mr. DAVIS. I can't get into the dual purpose reactor since I am not involved in that. From our point of view, from looking at power only reactors we have not been able to find that the water-cooled graphite reactor offered very much promise.

Mr. RAMEY. You don't agree with the Edison Institute or Dr. Zinn; is that right?

Mr. DAVIS. I don't know quite what their qualifications were, but we certainly have not so far decided that this is a promising type of power reactor.

(Applicable excerpts from the EEI report and Dr. Zinn's statement follow:)

Edison Electric Institute Report

(*b*) *Very-large-scale reactors.*—The generation of very large blocks of nuclear power in a single reactor is recognized as a way of reducing power costs. The construction of such a powerplant would require very large capital investment, and, therefore, can only be done for a reactor system of proven reliability. The

Hanford and Savannah River reactors in the United States are proven types. Either one, apparently, can be designed in a pressurized version. Either one could be constructed to yield 200 or more electric megawatts in a single reactor powerplant. Development work is required in both cases, but it is felt that the result of such work would leave no doubt as to the feasibility of the plants. The pressurized-water, graphite-moderated reactor would use slightly enriched fuel. The pressurized D_2O reactor could operate on natural uranium. It is believed that a power version of either machine could be a demonstration of large-scale nuclear power and plutonium production. An engineering design and analysis would permit a decision as to the desirability of constructing such a reactor.

TABLE II.—*Type and size of power reactors for new undertakings*

Project	Approximate electrical rating (megawatts)	Approximate time interval for project
• • •	• • •	• • •
H_2O cooled, graphite-moderated, Hanford type	250	1959–66

The qualifications described in the EEI list of February 21, 1958, included the following statement:

"NOTE.—The task force believes these types warrant consideration for new undertakings but that construction of any reactor should be undertaken only after thorough investigation, including necessary research and design which clearly indicates that carrying the project through to construction and operation will result in power costs approximating those obtainable from conventional plants in location under consideration. See discussion on pages 26 and 27."

Pages 26 and 27 of the report also point out that the reactor projects itemized in the list are given a rough order of priority with the Hanford type ninth in a list of 11 power reactor types.

Other relevant statements included in pages 26 and 27 of the EEI report are:

"In each project, research, development, and preliminary design are expected to precede a decision to construct."

"Not all of the reactors listed should be expected to be carried to the construction stage."

Excerpt from statement prepared by W. H. Zinn, June 23, 1956, page 525, authorizing legislation June 1957

In a list of reactor types Dr. Zinn included descriptions of advantages and disadvantages of some reactor types which could be given added emphasis in an expanding development program for power reactors. Under Hanford type reactors Dr. Zinn states:

"The advantages of the Hanford-type reactor are: (*a*) This reactor has by far the largest amount of design engineering and operating experience of any reactor type in existence. The operating characteristics of the current production models may not be markedly different from those of a power reactor.

"The disadvantages of the Hanford-type reactor are:

"(*a*) As with most water-cooled reactor systems, the fuel problem is large. Water is quite corrosive to most forms of fuel.

"(*b*) In a nonboiling version of a Hanford reactor, a high-pressure coolant system is required to suppress boiling within the reactor. Operating pressures of at least 1,000 pounds per square inch are required in the primary cooling system if a reasonable overall cycle efficiency is to be achieved.

"(*c*) This type of reactor appears to be worthwhile only in very large sizes. This is a disadvantage only if a reactor type must be developed for a very wide range of power outputs."

Representative HOLIFIELD. You may proceed.

Mr. FLOBERG. Paragraph 32. Incidental benefits: Every effort to derive incidental benefits from power reactors will be made. Such possible benefits include the use of radiation for food preservation or chemical purposes as in the case of sodium-graphite and aqueous

homogeneous reactors and the chemical processing of heterogeneous fuel elements to give the cheapest isotopes for supply of the rapidly developing isotope uses which are so beneficial now.

There follows a table, Mr. Holifield, which I assume you do not want me to read.

Representative HOLIFIELD. No. We will accept the 3 tables that are submitted here, or the 3 pages of tables, rather, for the record.

(The tables referred to follow:)

Summary of preliminary technical features of projected (fiscal year 1959–60) civilian power projects

Project		Approximate power		Moderator	Coolant	Fuel		Other technical features
Paragraph	Identification	Thermal (TMW)	Electrical (EMW)			Fissionable matter	Cladding	
3	Borax V	40	3.5 (existing T. G.).	H_2O	H_2O (boiling).	UO_2	Al-Ni	Forced or natural circulation. Flexible lattice for variable U. to H_2O ratio. Long (16-foot) pressure vessel for high riser experiments.
4	RCPA	58 (nuclear) 15 (fossil superheat).	22	H_2O	H_2O (boiling).	UO_2–ThO_2	S.S	Closed cycle. Natural circulation. Designed for future power increases.
5	Piqua	45	11	Terphenyl	Terphenyl	U Alloy	Al	Primary system mostly carbon steel.
6	Heavy water components test reactor.	60	0	D_2O	D_2O	U-235-Zr	Zr-2	Pressure tank with facilities for pressure tube experiments. 12 test assemblies for irradiation tests on full-size natural U fuel elements. Cold or hot moderator.
7, 11	High neutron economy reactor.	~400	~100	D_2O	Undetermined.	Undetermined.	Undetermined.	Operable on natural uranium fuel.
8	Gas-cooled power reactor.	100–150	30–50	Graphite	CO_2 or He	UO_2	S. S	Will test advanced fuel elements and other key components for civilian gas-cooled power reactors. Pilot for a large (200 EMW) plant. Exit gas temperature=1000° F.
9	LMFRE-I	5	0	Graphite	Bi	Solution or slurry of U in Bi.		Single region circulating fuel. Externally cooled. Volatile fission product removed continuously.
10	Undetermined	5–20	0	Undetermined.	Undetermined.	Undetermined.		
12	Large homogeneous (P. P. & L.).	300–600	70–150	D_2O	D_2O	Slurry of UO_2–ThO_2 in D_2O.		Chemical processing on side stream of primary system. Planned for eventual operation with U-233. Remote maintenance.
13	Homogeneous breeder	70	0	D_2O	D_2O	Solution (U sulfate) and/or slurry 4(U–Th oxides) in D_2O.		2 regions. Minimum size to demonstrate U-233–Th Breeding.
14	Small PWR	80–160	20–40	H_2O	H_2O	Probably UO_2 undetermined.		Undetermined.
15	SRE-II	20	0	Graphite	Na	Undetermined.		Intermediate neutron energy spectrum. Improved conversion ratio.
16	OMRE-II	20–40	0	Undetermined.	Organic	Undetermined.	Undetermined.	Flexibility for changing moderator and testing fuel variations for reduced decomposition rates.

16	OMRE-II	20–40	0	Undetermined.	Organic	Undetermined.	Undetermined.	Flexibility for changing moderator and testing fuel variations for reduced decomposition rates.
17	ECNG-FWCNG	200	50	D_2O	Gas (probably CO_2)	Probably UO_2.	S. S	Pressure tube. Be clad considered for future operation. Coolant exit temperature 1020° F.
18	CVNPG	60	17 (includes fossil-fired superheater).	D_2O	D_2O	UO_2	Zr-2	Pressure tube. Pilot for large (200 MW) plant.
19	Chugach	40	10	D_2O	Na	UO_2	S. S	Calandria tank for D_2O. Barrier for separation of Na and D_2O in case of multiple failures.
20	Molten salt	10–60	0	LiF–BeF_2	U-235 F_4 in LiF, BeF_2, ThF_4			Intermediate neutron energy. Circulating fuel. Externally cooled.
21	Process heat	20–40	0	H_2O	H_2O	Probably UO_2.	Undetermined.	Would provide steam for a chemical manufacturing process, such as paper.

Representative HOLIFIELD. Mr. Ramey.

Mr. RAMEY. There is one question on which you may want to submit the information for the record. That is what the projected cost of a program of the level that you have described would be for the next 5 years. It is noted that you have for 1959 about $65 million of construction and that you have added for your operating program as a result of your supplemental about $23 million to your base work.

If this were projected over 5 years this would not necessarily be such an expanded program.

Mr. FLOBERG. The farther ahead you go with projections the less reliable your figures become, of course; but I see no reason why we could not furnish some figures properly qualified.

Representative HOLIFIELD. If we pattern it on the 1959 program it does not represent a very strong effort.

Mr. FLOBERG. I think it does. There has been some increase in the level of promotion between 1958 and 1959.

Mr. RAMEY. In your fuel cycle development, there is a significant increase. Presumably if you were to build a heavy water reactor or if your capital expenditures otherwise increased then you would have to have supporting research and development effort to go along with it that would also require an increase of funds. I think your statement earlier recognized that industry, if it is going to make plans on how it is going to operate for the next 5 to 10 years, has to have some idea what these projections are going to be, even though admittedly the further out you go in time the less reliable the figures will be.

Mr. FLOBERG. We could submit such a projection, Mr. Chairman, and have no objection to doing so. It will obviously have to be qualified by these points that we have discussed. I certainly do not think that the Commission considers itself limited to the 1959 level for all future years, if that is the purpose of your observation.

Representative HOLIFIELD. You can answer. When I look at this program and see most of your items are something that may happen in the future and very few of them are items that are going to happen in the 1959 budget, my statement that you haven't a very imaginative or aggressive program for the 1959 budget—maybe it will help you some if the committee writes in a program that will be a little more aggressive.

Mr. VANCE. It might serve your purpose if we tried to give you a range of figures for this extension rather than a specific figure.

Representative HOLIFIELD. We might help you out with some of our staff if you are lacking in manpower to prepare some for us so you would have an aggressive program. Maybe if we would write you up a good program you fellows could follow along with us.

Mr. VANCE. My attention has been called to these figures which bear on our present discussion. The total operating expenses in this category under discussion in fiscal 1957 were $76.9 million. In 1958, $145.6 million. Projected in 1959, $194.2 million.

Mr. RAMEY. Do you have a breakdown on those figures, Mr. Vance?

Mr. VANCE. Yes, sir. Do you want them?

Mr. RAMEY. Yes; I mean for the record.

Mr. VANCE. Yes, sir.

(The material referred to follows:)

Summary of civilian power funding

[In thousands]

Operating expenses	1957	1958	1959
Operating costs: Civilian power reactors:			
Government program:			
1. Pressurized water reactor	$14,718	$17,574	$20,400
2. Boiling water reactor	5,004	3,959	5,513
3. Homogeneous reactor	10,896	14,568	14,300
4. Fast power breeder reactor	6,827	8,595	12,400
5. Sodium graphite reactor	5,955	7,510	8,800
6. Liquid metal fuel reactor	3,838	6,705	8,000
7. Organic moderator reactor	3,636	5,319	3,500
8. Plutonium recycle reactor	1,377	3,581	5,000
9. Pressurized heavy water reactor	397	1,975	5,500
10. Gas cooled power reactor		3,751	6,000
11. Advanced design studies	161	981	1,500
Total Government program	52,810	74,518	90,913
Cooperative arrangements program:			
1. Yankee atomic	1,197	2,156	1,647
2. Fast reactor system	62	900	1,250
3. Consumers Public Power District		2,500	6,000
4. City of Piqua		200	1,800
5. Chugach	222	1,694	2,000
6. Northern States		750	2,580
7. Pennsylvania Power & Light			5,400
8. Carolinas-Virginia			1,000
9. East Central-Florida West Coast			1,000
Total cooperative arrangements program	1,481	8,200	22,677
Reactor systems research and development [1]	9,873	11,138	10,000
Fuel cycle development			15,000
Reactor safety [1]	3,582	8,549	7,600
Separations systems development [1]	8,882	10,475	9,000
Equipment, civilian power			2,475
Total civilian power costs	76,628	112,880	157,665
Increase in goods and services on order: [2]			
Cooperative program	306	32,799	9,125
Contracts for test space in power reactors			12,500
Contracts for test space in test reactors			15,000
Total operating expenses	76,934	145,679	194,290

[1] Also applicable to military program.
[2] Does not include GSO for normal contractor prefinancing.

Mr. RAMEY. Is this just operation and construction?

Mr. VANCE. This is just operating money only.

Mr. RAMEY. And this includes the demonstration program, does it?

Mr. BURROWS. Yes; it is all civilian work.

Representative HOLIFIELD. Are there any further questions, Mr. Durham?

Chairman DURHAM. I have no questions.

Representative HOLIFIELD. Is there anything the Commission wishes to add?

Mr. VANCE. No, sir.

Representative HOLIFIELD. We will adjourn the meeting for today. We have, as you know, an executive meeting in the morning.

Mr. VANCE. And nothing between now and Monday.

Representative HOLIFIELD. Nothing between now and Monday. We will have some testimony on the plutonium reactor in executive session.

On Tuesday there will be an open session to take up the Pennsylvania Power & Light and the power demonstration program for 1958 and 1959.

Mr. FLOBERG. Is that Monday testimony you refer to from the Commission, Mr. Holifield?

Representative HOLIFIELD. That will be from the Commission and the Hanford operators. We will have the GE people. Perhaps Mr. Bloch from production and some of the Hanford people will be in at that time.

The staff will take it up with your staff and arrange the details.

Mr. VANCE. That will be an executive session?

Representative HOLIFIELD. Yes, sir.

The committee will adjourn.

(Whereupon, at 4:15 p. m., Wednesday, June 4, 1958, the committee was recessed, to reconvene in executive session at 10 a. m., Monday, June 9, 1958.)

AEC AUTHORIZING LEGISLATION

MONDAY, JUNE 9, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to notice, Hon. Chet Holifield (chairman of the subcommittee) presiding, at 10 a. m., in executive session, Room F–88, the Capitol.

(NOTE.—The original transcript has been reviewed by the AEC for classification purposes, and certain classified matter has been deleted.)

Present: Representatives Holifield, Durham (chairman of the Joint Committee), Price, Van Zandt, and Hosmer; and Senators Anderson and Jackson.

Also present: James T. Ramey, executive director; John Conway, assistant director; David R. Toll, staff counsel; R. N. Nelson, U. S. N., staff technical adviser; and George Murphy, of the Joint Committee on Atomic Energy; and Bernard V. Dvoskin, GAO consultant.

Representatives of General Electric Co., Hanford: W. E. Johnson, general manager, Hanford Atomic Products Operation; E. T. Maher, counsel; W. J. Dowis, engineer.

Representatives of Atomic Energy Commission: Commissioners Vance, Graham, Floberg, and Libby; E. J. Bloch, Director, Division of Production; G. F. Quinn, Deputy Director, Division of Production; W. K. Davis, Director, Division of Reactor Development; Don Burrows, Controller; Francis McCarthy, Assistant Controller for Budgets; Al Tammaro, Assistant General Manager, Research and Industrial Development; R. E. Hollingsworth, Assistant General Manager for Administration; Edwin Ferguson, Deputy General Counsel; Bryan LaPlante, assistant to the General Manager for Congressional Liaison.

Representative HOLIFIELD. The committee will be in order.

Today we will consider the question of additional facilities for plutonium production, and more particularly the Hanford situation. For that purpose we have representatives of the AEC and the GE Hanford atomic works here to testify.

But prior to this testimony, I would like, for your information and the record, to bring you up to date on the requirements question. As you know, the Military Applications Subcommittee has had the plutonium requirements situation under review by a distinguished panel composed of the following persons:

Mr. Gordon Dean, senior vice president, General Dynamics Corp.; and former Chairman of the AEC;

Dr. John Harold Lampe, dean of engineering, North Carolina State College;

Dr. John K. Wheeler, professor of physics, Palmer Physical laboratory, Princeton University; and

Mr. John Kenneth Mansfield, assistant to the director, nuclear division, Combustion Engineering, Inc.

We understand that the Panel has adopted findings and recommendations which would require substantial additions of plutonium production facilities. We expect to consider the Panel's report at a later session.

I don't propose to go too far into the requirements picture this morning.

I believe AEC is fairly well committed as to the necessity of at least anticipating increased future requirements for plutonium. You requested authorization from the Budget Bureau for a plutonium reactor, did you not, Mr. Vance?

Mr. VANCE. Yes, sir.

Representative HOLIFIELD. Also AEC and the Bureau supported the need for a revolving fund in excess of $200 million for the purchase of foreign plutonium for weapons purposes; did you not?

Mr. VANCE. Yes.

Representative HOLIFIELD. Today we have with us Mr. W. E. Johnson, manager of the GE Hanford atomic works, who will lead off on reporting on the design study for alternative types of plutonium reactors which was authorized by the Joint Committee and the Congress last year.

Following Mr. Johnson we will have Mr. Bloch, AEC Director of the Production Division, comment or make a statement. We would also be happy to hear further from the Commissioners and the General Manager.

Senator Jackson?

Senator JACKSON. Before calling Mr. Johnson, I want to report that the Advisory Committee on Reactor Products will have their formal report ready for submission tomorrow, which is virtually the final draft. I have read it and as you have indicated they recommend a very substantial increase in reactor products. This report will be ready tomorrow, and I would like to ask permission to have included when it is ready tomorrow in the record of your legislative committee the report that will be submitted inasmuch as it is highly pertinent to your undertaking.

Representative HOLIFIELD. And this is an unclassified report?

Senator JACKSON. This is classified as of now, but there will be an unclassified version made available.

Representative HOLIFIELD. Without objection we will enter that into the record and proceed to have that declassified until we have an unclassified version.

Senator JACKSON. As of tomorrow if we could submit as a classified document and if in the meantime we could have the opportunity to have it declassified.

Representative HOLIFIELD. All right. Now, Mr. Johnson, I guess we are ready for you. You may proceed.

STATEMENT OF W. E. JOHNSON, GENERAL ELECTRIC CO., GENERAL MANAGER, ATOMIC PRODUCTS OPERATION

Mr. JOHNSON. Mr. Chairman and gentlemen, I have a prepared statement.

May I proceed?

Representative HOLIFIELD. You may proceed.

Mr. JOHNSON. My name is Wilfred E. Johnson. I am general manager of the Hanford Atomic Products Operation, the organization through which the General Electric Co. operates the plutonium plant and performs research and development work at the Atomic Energy Commission's Hanford facilities.

On October 14, 1957, our organization was requested by the Atomic Energy Commission to perform the preliminary development, design, and engineering work on a large scale singie or dual purpose production reactor for the production of special nuclear materials for which an appropriation was authorized by Public Law 85–162. This work was accomplished by our organization at Hanford, and by Burns & Roe, architect-engineer contractors of the AEC with headquarters in New York, working under our technical direction. I understand that copies of our report have been furnished to the Joint Committee by the Atomic Energy Commission. As may be readily noted, our conclusions and observations are substantially the same as those reported to the committee by the Commission.

Our work on this project was a formal extension of some earlier studies which the company performed at Hanford and which I described generally to this subcommittee last year.

As our report indicates, the basic assumption underlying our study was the existence of a substantial requirement—which would continue for some period of years after startup—for additional plutonium production capacity. This led, as you may note, to the use of design heat ratings in the higher ranges for all cases except those in which the heat rating was deliberately reduced in order to show the more favorable economics of increasing the proportion of heat used for power takeoff.

Subsequent to the submission of our formal report, in response to a Commission request, we forwarded a preliminary and informal estimate of the economics of a smaller dual-purpose reactor in which all of the heat would be used for power recovery, and which would deliver 300 megawatts of electric power. There was, of course, insufficient time to do this latter work with the same degree of thoroughness as that embodied in the formal report, but our estimates were made in the degree of detail that was possible in the time allowed.

Similarly, we have submitted an even more preliminary estimate of the economic features of a similar dual-purpose plant of 500 electrical megawatts rating.

The results of the formal study and of the subsequent preliminary estimates have been presented as a series of differing plant designs, all based generally on the same reactor technology, with each design selected so as to be suitable for one or more different purposes. These designs were then further analyzed to determine their economic performance under different operating conditions.

I will not repeat here the figures produced by our study, or the several conclusions which may be drawn from them. The figures and deductions are stated in detail in the report of our study and our subsequent letters, and in the Commission's report to the Joint Committee.

By way of general background, however, I think it might be helpful for me to digress here to give you a very brief summary of the reactor designs our study considered.

Due to time limitations, it was necessary to limit detailed study to a single Hanford site and to a single basic reactor concept which would be capable of economic production of plutonium as a single plant product but which also would be capable of conversion to dual-purpose operation or, ultimately, to operation for the production of electric power only. As the Commission has indicated, the reasons for the selection of this design were—

1. This design included the flexibility for operation either as a single-purpose plutonium producer or dual-purpose unit, or initially as a single-purpose unit with a later conversion to dual-purpose operation.

2. The design offered promise of lower investment cost per thermal megawatt and lower unit cost of plutonium production than the improved version of the existing Hanford K type reactor; a choice of either single- or dual-purpose operation; and an opportunity to acquire additional valuable technical data from the necessary design and development work.

3. A significant amount of technical data which could be applied to the engineering design of the proposed new reactor had already been developed by the General Electric Co. in the continuing research and development program at Hanford, aimed at improving the performance and safety of the existing Hanford production reactors and developing the design parameters for improved production reactors.

From the basic reactor concept, we studied in detail several alternate design cases, and from these cases developed a number of generalized reactor designs based on the more detailed studies.

I have put on the board a chart which summarizes the more important economic data pertinent to these various cases, and I will, at the conclusion of this statement, review these figures with you, if you desire.

These reports make it abundantly clear, we believe, that—as I stated in my discussion of this subject last year—the selection of an appropriate atomic plant design is a complex problem. A satisfactory solution probably cannot be achieved in any case except in terms of the selection at the very outset of the basic objectives sought to be achieved by the construction of the plant.

In our work, answers to the critical question—namely, for how long will additional plutonium capacity be required—were, as I have indicated, assumed. I wish to emphasize again that our assumptions in this regard do not indicate any opinion or recommendation whatever respecting either the existence of such a requirement or its duration These are matters solely for the Government to determine.

We believe that our analysis of the dual-purpose-design concept has demonstrated the importance of the assumptions stated in our report, particularly as to Government financing. It is clear that

wholly different results would obtain under conditions of private financing, which we estimate would entail capital charges 10 or 11 percentage points higher than the Government-financed case. As an example, under AEC accounting practices, capital charges for a Government plant would include only 4 percent straight-line depreciation charge. Plans for private financing, on the other hand, would have to make provision also for Federal and local taxes, profits for the suppliers of the risk capital, insurance, and interest on borrowed money, and these factors alone would account for a very substantial difference in the unit cost of plutonium.

Our work has indicated that a dual-purpose plant can be designed and operated both for maximum plutonium production and maximum power generation. To illustrate the economics of full heat utilization for the generation of 700 electrical megawatts, our formal study report included a plant with reduced heat rating, and consequently lower plutonium production. It should be understood, however, that there is no technical compulsion for such a design limitation upon reactor thermal capacity if maximum plutonium production is desired. We estimate that at a modest additional capital cost over that given for the 700 electrical megawatt plant referred to in our report, the maximum thermal rating and the corresponding maximum plutonium production could be maintained along with the power rating of 700 electrical megawatt. If desired, of course, this electrical power rating could be increased by increasing the degree of reactor heat utilization.

In general, I believe that two characteristics of the dual purpose concept may be noted here:

1. The first of these is that with respect to reactors of comparable thermal rating, dual purpose is an economically practical route only if more than 25 percent of the heat generated by the reactor is used for power recovery. At 25 percent heat utilization the dual-purpose plant must be operated for the full plant lifetime to compete economically with a single-purpose plant. On the other hand, if the heat utilization is increased to one half or more, the dual-purpose plant will be the more economical without regard to the duration of the demand for plutonium.

2. The second characteristic is that, assuming three-quarters or more of the heat is utilized for power recovery, a new dual-purpose plant would economically replace [classified data] the older Hanford reactors if the present requirement for plutonium continued for approximately 4 years after the plant startup, provided the plant were operated for power only during its remaining life. On this replacement basis the comparable period required for economic justification of a new single-purpose plant would be approximately 15 years of operation after startup.

As our report points out, considerable development work remains to be done on the single- and dual-purpose reactor designs we have studied, particularly in the fuel element area. We believe, however, that while development problems could result in the necessity of operating a new plant for some period of time at less than optimum conditions, difficulties of this kind would not substantially reduce the plutonium production of these plants.

Irrespective of the current estimate of the duration of plutonium requirements, of course, there is a possibility that a dual-purpose

plant would have some salvage value in the open market in the event the demand for weapons-grade plutonium in fact dropped to zero at an early date. Any such market salvage value is highly speculative, however, because today's plant will be competing in aconomics and performance with the atomic powerplants of the indefinite future.

It is also possible that the dual-purpose plant might offer some advantage if the demand for weapons-grade plutonium became variable, dropping radically for uncertain periods and then reviving, since such a plant could be used for power only operation during the periods of slack demand. In considering this feature, we must, of course, recognize that a single-purpose plant could be kept in standby condition and ready to resume operations. However, the maintenance of the plant in a "ready" condition would be fairly costly and, of course, the capital investment would be idle during such period.

I would like to emphasize that in the process of evaluating and selecting future plant designs, it is essential particularly to note that the dual-purpose concept is one of a power-generating station and a plutonium producer. We do not believe that a complete economic evaluation of that concept as compared with others can be made without referral to the utility industry. In the final analysis only that industry can fully appraise the possibilities of its participation in the financing, construction, and operation of all or any part of a dual-purpose plant.

In this connection let me emphasize also the importance, which is remarked both in our report and in the Commission's, of the value taken for the electrical power produced by the dual-purpose plants. The reports demonstrate that this value has great influence upon the study results. The 3.58 mills per kilowatt-hour used in our studies is based upon a Bonneville Power Administration formula. While this is a reasonable enough assumption for certain purposes, it is in no sense a universal value. It could vary widely and we do not now know what values would be assigned by utilities in view of the many variables of their own operating situations.

Mr. Chairman, as I mentioned in the written testimony, there is on the blackboard a tabulation showing the comparative economic results that may be expected from reactors of each type.

Representative HOLIFIELD. I suggest that you go through that line by line and give us the benefit of it.

Mr. JOHNSON. Going down on this tabulation, the first line is a single-purpose plant for production of plutonium only and is not designed in such a way that it could be converted to dual purpose.

Line 1b is the same kind of reactor, except that features have been included to permit convertibility at a later date to dual-purpose use.

This item 2——

Representative HOLIFIELD. Let us take that across the board there.

Mr. JOHNSON. Going across the board on the ratings, there is the heat rating on the left [classified discussion].

Representative HOLIFIELD. Thermal megawatts?

Mr. JOHNSON. Thermal megawatts, and the plutonium-production rating which is in kilograms per year.

(Classified discussion.)

Representative HOLIFIELD. What is the third column?

Mr. JOHNSON. The third column is millions of dollars capital cost estimated. The last two columns give the unit cost of producing

plutonium with an arbitrary selection of this case taken at 100 just for comparison. Those are not the actual dollar figures. We put on comparative figures.

(Classified discussion.)

Representative VAN ZANDT. Am I right, Mr. Johnson, in assuming in that convertible you might get a return for your power, too?

Mr. JOHNSON. If it is converted. This is assuming it is converted.

Representative VAN ZANDT. But the way you converted——

Mr. JOHNSON. Then you have one of the other indications except that the capital cost finished will be slightly higher, doing it in two stages.

Representative HOLIFIELD. Is that chart prepared so we could use that on an unclassified basis? Is it prepared without going into the cost?

Mr. JOHNSON. I don't believe so, unless we leave off the heat ratings.

Representative HOLIFIELD. So the whole thing will have to be purged anyway.

Mr. JOHNSON. Yes.

Representative HOLIFIELD. We might just as well discuss it and convert to what is meaningful to us in terms of dollars, then, and later on we can have a declassified chart prepared.

Mr. JOHNSON. The reason we did not put the dollars figures down is that we would have to call it top secret and it makes it a little more difficult to handle. We have a copy of this we can leave for the record.

Representative HOLIFIELD. Yes.

Senator JACKSON. Under item 1b, Mr. Johnson, is that capital cost figured upon the assumption that it will be convertible into a 300,000-kilowatt powerplant?

Mr. JOHNSON. It can be converted to either that or to the 700,000.

Senator JACKSON. Either one, depending on how you want to do it?

Mr. JOHNSON. Yes. I think the capital cost after conversion is somewhat higher than if you had built the plant as a dual purpose plant initially, and the estimates on that are fairly rough.

Senator JACKSON. From a technical standpoint is the state of the art far enough along to warrant the assumption that you could go ahead now on a dual-purpose reactor? I am speaking only from the standpoint of the state of the art and as to the progress that you have made.

Mr. JOHNSON. There is no technical reason why a reactor suitable for dual purpose should not be designed and constructed. There is obviously a question mark as to whether the fuels that we expect to develop will in fact work and, until they are actually proved out in operation, there could be no real assurance you could take power off such a plant.

Senator JACKSON. So that the convertibility feature offers an opportunity to learn more about the fuel elements?

Mr. JOHNSON. Yes.

Senator JACKSON. So that when you become operational you might be in a position to have a better overall working plant than you would if you arbitrarily proceeded to build the full facility at the outset?

Mr. JOHNSON. That is correct.

Representative VAN ZANDT. Mr. Chairman.

Representative HOLIFIELD. Mr. Van Zandt.

Representative VAN ZANDT. The convertibility feature that is contained in 1b, Mr. Johnson, will there be an increased cost if the plant that is producing plutonium and then you wish to take advantage of the convertibility feature to produce power, will there be additional capital investment?

Mr. JOHNSON. Yes, there will be, and our statement I think is about $10 million more. That is right.

Representative VAN ZANDT. Instead of $145 million, it would be $155 million?

Mr. JOHNSON. Not initially. The initial cost would be $145 million, but after the plant were converted the sum of that cost and the cost of converting would be about $10 million more.

Representative VAN ZANDT. All right.

Mr. JOHNSON. ——— than if constructed at once for a dual-purpose plant.

Senator JACKSON. For what size plant? Is that 700?

Mr. JOHNSON. Seven hundred, yes.

Mr. RAMEY. May I clarify that point? In other words, the net additional cost of going the 2-stage convertible route would be $10 million?

Mr. JOHNSON. Yes.

Senator JACKSON. But in order to start off, you would be expending an additional $20 million over what you would have spent for a single-purpose plant?

Mr. JOHNSON. $25 million.

Senator JACKSON. So the total would be $35 million?

Mr. JOHNSON. No. Some of this development is useful development if you convert.

Mr. RAMEY. If you convert it is a useful development.

Senator JACKSON. Is there an additional $10 million over the $145 million?

Mr. JOHNSON. The cost of the finished plant is listed here at $245 million; instead of that $245 million, it would be $255 million.

Representative HOLIFIELD. I see.

Mr. JOHNSON. Had we started out with $145 million.

Senator JACKSON. That is the 700,000 kilowatt.

Mr. JOHNSON. Right.

Senator JACKSON. But for the 300,000 kilowatt it would be 188 plus the 10; it would still be 10 either way?

Mr. JOHNSON. We don't know accurately enough.

Senator JACKSON. May I ask a question, Mr. Chairman, on the same point?

Representative HOLIFIELD. Yes.

Senator JACKSON. We are talking about $10 million here as the additional factor in the event that you decide to go to power. It could well be said, I assume, that if you follow the route of taking direct action now for a duel purpose plant, you might run into enough difficulties and additional costs that $10 million would not be a large factor in this. Isn't that conceivable, taking into consideration the technical problems and the efficiency of the plant in producing power and plutonium?

Mr. JOHNSON. I would think that is a fair statement, Senator.

Senator ANDERSON. You don't believe the technology is far enough along for you to go ahead and build? Do you think there is a lot of difficulty in it?

Mr. JOHNSON. I think it would be the course of prudence to do it in two steps. We don't have the fuel elements developed to the point of being proved. We are quite confident they will be proved and that they will be satisfactory, but when we talk about producing plutonium, when we can always drop the temperature to the point where the fuel element will be satisfactory. Getting up to the high temperatures is something we would like to prove before we see a lot of dollars committed to a power-generating station.

Senator JACKSON. You still get your power but it is a question of taking advantage of your opportunity to further pursue this fuel-element problem while you are building the plant; is that correct?

Mr. JOHNSON. Yes; correct.

Senator JACKSON. We are dealing here with a 4-year construction period, offhand?

Mr. JOHNSON. We would expect to have fairly good tests on the fuel element in about 2 years.

Senator JACKSON. In about 2 years. So that when you get near the completion stage by investing this additional $10 million you would be in a position to take advantage of the 2 years of trial and error to find better answers to the heat problem, the fuel elements. So it would be fair to say there is a reasonable chance of having a better dual purpose reactor than if you plunged now into the decision of deciding exactly what you should do for a period of 2 or 4 years hence.

Mr. JOHNSON. I think that is correct. This is obviously a matter of judgment which one has to exercise.

Senator JACKSON. That is right. I am only directing my remarks, Mr. Johnson, on the question of the technical aspects, not the policies. Just so that we have it, Mr. Chairman, to decide what is involved in the various courses or approaches that you can make in achieving whether you want single or dual or a convertible process in the interim.

Representative VAN ZANDT. Mr. Johnson, suppose that we build 1b reactor convertible and we spend the additional $10 million, and we are now producing plutonium and power. Suppose the need for plutonium drops off. Can you continue to operate it for the production of power only?

Mr. JOHNSON. Yes, sir. It is designed with that in mind.

Representative VAN ZANDT. In other words, the flexibility is placed in the reactor as a result of the $10 million additional expenditure.

Mr. JOHNSON. Yes; the fuel element would be changed from the metallic type to the oxide type.

Representative VAN ZANDT. That is understood, yes.

Representative HOLIFIELD. Now, in the first place, if you use that for plutonium and power both, what is the cost of your power? Is that figured at 3.8 mills?

Mr. JOHNSON. 3.58 mills is the figure we have been using.

Representative HOLIFIELD. If plutonium is no longer of value to us, how much does that raise the cost of your power?

Mr. JOHNSON. The figures we have presented here are based on the value of power continuing at 3.58 mills.

Representative HOLIFIELD. Regardless?

Mr. JOHNSON. Yes.

Representative HOLIFIELD. In other words, if we did continue to need plutonium, which there is very good evidence we will over a period of time, that plutonium would come as a bonus, would it? Your power would go forward at 3.58?

Mr. JOHNSON. We assumed in the case of power only production the plutonium was only worth $12 per gram. We took the standard price for plutonium under those conditions.

Representative HOLIFIELD. I see. So you still get plutonium. Now, if the plutonium was not needed for weapons any longer, but in the meantime we had solved the problem of burning, then you would still be able to use that plutonium for fuel.

Mr. JOHNSON. Yes.

Representative HOLIFIELD. If we solved the plutonium recycle, we could reproduce that as enrichment and obtain additional thermal watts out of that.

Mr. JOHNSON. I believe this assumed that. Actually in the price of plutonium there is the basic underlying assumption it is usable as a fuel. We have assumed this $12 figure.

Representative HOLIFIELD. But this point has not yet been technically solved, has it? The burning of plutonium?

Mr. JOHNSON. No.

Representative HOLIFIELD. But you are confident that you will?

Mr. JOHNSON. Yes, sir; we are.

Representative VAN ZANDT. What is the life of this first 1a and 1b reactor? Fifteen years? That type of reactor?

Mr. JOHNSON. No; we would expect it to last 25 years.

Representative HOLIFIELD. How do you bring in your 4 years? I noticed in your statement that you mentioned a 4-year period.

(Classified discussion.)

Representative HOLIFIELD. On page 5, item 2, where you said plutonium continued for approximately 4 years after plant startup?

Mr. JOHNSON. Yes. I will try and explain that. When we are talking about replacement of existing reactors, we have gone at it from the point of view that here are two ways of obtaining plutonium. One way is to continue operating the old reactors and assuming they would continue to operate. The other method is to build a new dual-purpose reactor. The problem then hinges on how long the demand for plutonium lasts. It turns out that if the demand for plutonium continued for 4 years or more the cost of producing the total amount of plutonium will be less by building a dual purpose reactor. If the plutonium demand should last for less than 4 years, then the cost of producing plutonium would be less if we continue with the old reactors. In each case I am talking about the number of years after the startup of the reactor.

Representative HOLIFIELD. But if the need for plutonium did continue more than 4 years?

Mr. JOHNSON. You get that cheaper by the dual-purpose reactor.

Representative HOLIFIELD. You get it cheaper by the dual-purpose reactor?

Mr. JOHNSON. Yes; assuming that after the demand does cease the reactors continue to be operated for production of power only.

Representative HOLIFIELD. This is not your concern, but the concern of the committee. We have been approached by the Commission asking us to give them the right to make a contract for 15 years, and later on for less than 15 years, so what you would be gambling in that long-term contracting would be 15, 7, or 10 years, whatever amount was requested wherein this you would only be gambling 4 years need.

Mr. JOHNSON. Yes; 4 years after the plant had been finished, Mr. Chairman.

Representative HOLIFIELD. Yes; I understand.

Senator JACKSON. If single, Mr. Chairman, it would be 15 years. Isn't that right?

Mr. JOHNSON. That is right.

Representative HOLIFIELD. You gamble 15 years on a single purpose.

Mr. JOHNSON. Yes.

Senator JACKSON. In order to amortize payout.

Mr. JOHNSON. This is not a payout concept, the books could be kept on a payout basis.

Senator JACKSON. It is a replacement.

Mr. JOHNSON. This is assuming, or this is the point at which the plutonium product costs you no more by either method, the dual-purpose plant at 4 years and single purpose 15 years.

Representative HOLIFIELD. If we built the dual purpose then and gambled for 4 years on plutonium, you are still figuring a 25-year life for power production?

Mr. JOHNSON. That is right.

Representative HOLIFIELD. If you needed at any time to increase that plutonium production from the level of the dual-purpose production to the single purpose, could you do that, after you had built the dual-purpose plant? Could you increase by raising your heat rate or different types of rods, could you increase your plutonium production?

Mr. JOHNSON. The heat rating can be maintained for [classified data] the larger reactors. It does not have to be reduced. This case here is a case which we have shown just for illustration of the effect on unit cost.

Representative HOLIFIELD. So the penalty you are paying is [classified data] to maintain a dual purpose in place of a single purpose, is that correct?

Mr. JOHNSON. That is correct. This plant could be run at this heat rating with this amount of production.

Representative HOLIFIELD. These are amazing figures and they are quite a bit different from the figures you gave us last year; aren't they?

Mr. JOHNSON. Not very much, Mr. Chairman. I have the figures of last year. The actual results are difficult to compare because the designs we are talking about are not quite the same. We can't make a straightforward comparison.

Representative HOLIFIELD. Your No. 4 would come closest to it; would it not? No; your No. 2 of last year, which was 700 electrical megawatts——

Mr. RAMEY. That would correspond to example No. 3a up there, which is your lowered output one, not the 3b. [Classified discussion.] They did not have the 3b example last year. I think that is the difference.

Mr. JOHNSON. The single-purpose plant we had last year showed a 1957——

Representative VAN ZANDT. A little louder, please.

Mr. JOHNSON. Last year we talked about a 1957 J plant as a single-purpose design. We quoted a capital cost of about $118 million, I believe, and the single-purpose job this year is $120 million. That is somewhat accidental, because there is a fair amount of difference in the designs. The single-purpose job last year was quoted at a smaller rating [classified data] whereas this year we are talking [classified data]. Also last year we talked——

Senator ANDERSON. Is that because of the new design that you get more production from it?

Mr. JOHNSON. It was somewhat arbitrary selection, Senator. We were not sure last year just what level of heat rating would be desirable. [Classified discussion.] This year we have fairly definitely decided the economical thing to do is take all we can out of the reactor. [Classified discussion.] I should emphasize, however, that in the dual-purpose case these figures are very sensitive to the value of power for one thing.

(Classified discussion.)

Senator ANDERSON. Does that apply in other parts of the country? For instance, 5.5 mills is not too attractive in the Northwest, but would be rather attractive in the New England States. Would there have to be a reevaluation of the whole thing?

Mr. JOHNSON. Senator, we have emphasized several times in letters, as well as in this testimony, we cannot get good answers to this without consulting the utility industry. The reason for that is that our figures are all based, for example, on the particular conditions in the Northwest where we believe that we can utilize the plant for 80 percent of its operatng time.

Senator ANDERSON. If they are paying 8.5 mills or 9 to generate current and could get it for 5.5, the probabilities are—those Yankees are pretty good businessmen—they might take it at 5.5 rather than produce it at 8.

Mr. JOHNSON. Let me emphasize, if the plant could only run 40 percent of the time, for example, the cost of the power would roughly double, you see.

Senator ANDERSON. Yes.

Mr. JOHNSON. And an average steam plant over its lifetime I think runs between 45 and 50 percent utilization.

Senator ANDERSON. The only reason I asked the question was if we did need additional plutonium after this plant got into operation, it might furnish a clue as to how you could expand power requirements in the New England States if the New England utilities want to do it. If you paid a fair price for plutonium, you would bring the price down even if operating conditions are different from what they might be in the Northwest.

Mr. JOHNSON. This is a subject that perhaps should be investigated, Senator, but let me again mention it. Of course, they have different capital charges than we have in a Government plant.

Senator ANDERSON. Yes.

Senator JACKSON. Will the gentleman yield?

Senator ANDERSON. Yes.

Senator JACKSON. Isn't it well to find out in discussing other areas you do have two other points? One is that you are speaking in terms of an integrated system where you have the separation facilities available. I assume that bears on the cost.

Mr. JOHNSON. Yes.

Senator JACKSON. And secondly, wouldn't it be important to take into consideration how the power output would be integrated into a system?

Mr. JOHNSON. It is a very important consideration.

Senator JACKSON. I mean those two things. You have to know the behavior of their power requirements at different times and so on because you will have shutdown periods here.

Mr. JOHNSON. We will have shutdowns and they will be unexpected shutdowns. It so happens in the Northwest, and I think probably in the TVA area with hydraulic power you can immediately bring power on the line to replace any dropoff that we might have.

Chairman DURHAM. How about the time element now between A and B? I am thinking about this situation of getting plutonium. That means about 4 years before you can get it out of 8, as I understand your statement. It will take 4 years to construct it. What is the time length in constructing A?

Mr. JOHNSON. Mr. Durham, we don't think it will be too much different. If we get into a crash program we can probably save 3 months or so on any schedule.

Chairman DURHAM. Then either one of them would take about the same length of time to get plutonium production started?

Mr. JOHNSON. Within a few months.

Chairman DURHAM. Now, how about your processing facilities out there at the present time? Could it take care of one reactor or two reactors?

Mr. JOHNSON. We can take care of two.

Chairman DURHAM. With the amount of production like this?

Mr. JOHNSON. We can take care of two.

Representative HOLIFIELD. Do you have enough separating facilities for two of this size?

Mr. JOHNSON. Yes.

Representative VAN ZANDT. In addition to the present reactors?

Mr. JOHNSON. Yes. The reason for that, we have assumed that this design will permit us to expose the fuels to [classified data].

Chairman DURHAM. By the time either one of them are completed, the reactors out there would be how old? about 20 years old?

Mr. JOHNSON. Yes; about. The first three reactors were built in 1943; 15 now. It would be approaching 20 years.

Representative HOLIFIELD. How many years?

Mr. JOHNSON. About 19.

Chairman DURHAM. About 19. Before we can get any production over what we have at the present time, the present reactors will be 19 years old, is that correct?

Mr. JOHNSON. Yes.

Senator JACKSON. They went critical in 1944; did they not?

Mr. JOHNSON. I believe they were finished in 1943. No, 1944.

Senator JACKSON. Since we are on this subject, what is your opinion of the life of the reactors presently operating there at Hanford, the first three I am talking about?

Mr. JOHNSON. It is very indefinite. What is basically happening is they are getting more expensive to maintain as time goes on. There is more radiation leakage.

Senator JACKSON. Could you give us percentage figures on how much more expensive?

Representative HOLIFIELD. A yearly figure you could give us.

Mr. JOHNSON. I don't know that I could quote a figure for the record that would hold up without checking it.

(Classified discussion.)

Chairman DURHAM. In selling these things to the Congress it is pretty essential and important that we have them. It is not so easy here now to sell a $45 million or $245 million, or whatever it happens to be. It is quite a sizeable figure.

Mr. JOHNSON. We can supply the figure if you wish.

Chairman DURHAM. What I have been concerned about is the life of those reactors. Will you supply that for the record?

Mr. JOHNSON. I don't think we can estimate the life, sir. It is quite indefinite.

Chairman DURHAM. I know they surprised us all. Certainly when I went out there when they were first built somebody said that they would last 8 for 10 years, and nobody said over 10, but they are still operating.

Mr. JOHNSON. I would say they are good for another 5 years. Beyond that they may last another couple of years.

Representative HOLIFIELD. If you say that these old reactors have a reasonable expectation although with a rising cost to us of another 4 or 5 years that would essentially make them a 25-year-life reactor. It seems like to me with your increased technical knowledge you are being very conservative when you amortize the new ones at 25 years. It would seem to me your technology has increased unless there is some reason I am not acquainted with, where your reactor now might be a 35 year operational life.

Mr. JOHNSON. That might be. The major factor that might change that would be the temperature of the graphite which is going up higher.

Representative HOLIFIELD. The deterioration of the graphite?

Mr. JOHNSON. Yes, sir. The tubing would not be a problem.

Chairman DURHAM. You said I believe that this fuel element wasn't far enough along in the basic research stage or proving whether or not it is feasible. Will that work be carried on regardless of whether or not we build a plutonium reactor? I mean on the fuel elements that would apply to a dual-type reactor.

Mr. JOHNSON. We expect to; yes.

Chairman DURHAM. That work will be carried on?

Mr. JOHNSON. We expect to carry that on.

Representative HOLIFIELD. If we should build one of these in anticipation of replacement of those first 2 or 3, can you give us a comparison between the [classified data] and the amount that the first 3 are producing at this time? [Classified data.] How does that compare with the production of the first three at this time?

Mr. JOHNSON. I will have to do some arithmetic I think.

(Classified discussion.)

Representative VAN ZANDT. Just for the purpose of refreshing my memory here, what would the cost be and is it possible to rehabilitate the existing reactors, say the first 3 at Hanford, where we might add another 15 or 20 years to them? Is that possible?

Mr. JOHNSON. We can put in zirconium tubing and we are considering the feasibility and desirability of doing that. Although we think it would be most economical on the newer reactors. We doubt whether it will pay off to renew the old ones, depending on what other things are going wrong. The other things going wrong are of course some distortion of the graphite which slowly continues and radiation leakage to the shields. They gradually deteriorate with the consequence you can't put men in there for as long to do a replacement job, and it causes the cost to rise.

Representative VAN ZANDT. They are certainly defects developing, and then you have the contamination problem regarding repairs. Are you in a position now to make a statement that it is possible to repair these reactors to extend their lives say for another 15 or 20 years, or is it not possible, or would you suggest we go into new construction?

Mr. JOHNSON. I would think that if we want assured production of plutonium, the wise course is to go to new construction.

Representative VAN ZANDT. Then we are safe, however, in your mind for the next 4 to 5 years? We can depend on the existing reactors to produce plutonium as they are today doing while we go into the construction program.

Mr. JOHNSON. We believe so.

Representative HOLIFIELD. Getting to that point that he raised, if you did put the zirconium tubes in the old reactors, then you would still be faced with the distortion and contamination of your graphite?

Mr. JOHNSON. That is right.

Representative HOLIFIELD. And if you did anticipate getting, say, another 15 years out of it, you would have to gamble on the graphite standing up that long; would you?

Mr. JOHNSON. The graphite and the shields.

Representative HOLIFIELD. And if they did not, your gamble of tubing would be lost?

Mr. JOHNSON. Not entirely, sir. The zirconium tubing under some conditions will pay for itself in fairly short time because of the kind of continued replacement job we have. We are always replacing tubes today. If we are going to use a reactor for 4 or 5 years, it may pay to have zirconium tubes in there just to lessen that replacement cost.

Representative HOLIFIELD. Your plutonium coming out of the reactor now is costing you quite a bit more than you anticipate this would cost?

Mr. JOHNSON. Yes.

(Classified discussion.)

Senator JACKSON. Might I just make this point. We have been considering of course the need for plutonium in addition to our present capacity.

Mr. JOHNSON. Yes.

Senator JACKSON. I think when we consider the pending matter we have to consider realistically the problem of replacement. We have assumed right along that we would maintain existing capacity and then have been thinking in terms of supplementing it. So actu-

ally if one is to be reasonably conservative on this you can't very well say we are going to have the 2 old ones at Hanford beyond 5 years. I think this makes for an entirely new situation here in addition to the requirements that we have been previously advised in the Military Applications Committee.

Representative HOLIFIELD. At this time, it is going up in price as Dr. Johnson testified—and he is going to give us the figures on how much it is going up—at the end of 5 years that figure might be higher according to the deterioration of reactor and cost of maintenance and that sort of thing. So even that figure is not a firm price for the next 5 years.

Representative HOSMER. I was wondering if you took one of those old reactors and gutted it, and threw out everything and all the plumbing that goes with it and put in a new reactor, you would probably get better efficiency out of that and, if so, how much, and how much would it cost.

Mr. JOHNSON. I don't have your question.

Representative HOSMER. Take one of your old existing reactors, the oldest one, take out the plumbing, the graphite and fill the new reactor, using the same building and other facilities around it. I am wondering how much it would cost to do that and wondering too if you could build a reactor that is more efficient.

Mr. JOHNSON. The new ones would be much more efficient than the old, but we don't think that it would be economical to try to put it in the same building or on the same plot of ground.

Representative HOLIFIELD. When these old reactors finally fail on you or become so expensive that it is no longer economically justifiable, your best bet then because of the hotness of it is to just cement it over and leave it?

Mr. JOHNSON. Yes; we would salvage whatever equipment we could—motors, pumps, instruments, things of this sort.

Representative HOLIFIELD. Yes. As far as that mass of graphite and superior rods that would really be a hot mass, and if you would try to clean that out you would be up against a real job of dangerous handling, would you not?

Mr. JOHNSON. We would; and it would be very expensive to do so. It would be much cheaper to build a new block than to try to salvage an old one.

Representative HOLIFIELD. Would you plan on just cementing these over and leaving them there?

Mr. JOHNSON. We would plan to leave them. I don't think we would have to cement them. We might close them up to be sure nothing leaked up; seal it, in other words.

Representative HOLIFIELD. That is what I meant.

Mr. JOHNSON. Yes.

Representative VAN ZANDT. You mean seal the reactor itself?

Mr. JOHNSON. Just to avoid loose graphite and radioactive graphite and things like that from getting out.

Senator JACKSON. I think you have made an excellent statement here, Mr. Johnson, and brought up a fact we have not considered: The three old reactors face a life expenctancy problem either from actual expectancy or the cost problem becomes such that one would have to make the decision of a replacement. I think that it can go either way. Conceivably these reactors might continue well beyond

5 years, but it is a question of how much you want to pay for it. Isn't that about it?

Mr. JOHNSON. Yes; I think so, Senator. I would like to make the record clear, however, by having it understood that when we shut down a reactor, we do not save the money that it is costing us. This includes overhead to the whole plant. You save some fraction of that. What we have done in our analysis is try to analyze in detail what actual out-of-pocket dollars would be saved and what out-of-pocket dollars would be spent on a dual purpose to get this comparison on replacement that I quote. I gave the 4 years and 15 years.

Senator JACKSON. If you replace the high-cost reactor with a more efficient one, single or dual, saving money assuming you are running it up to full separation capacities.

Mr. JOHNSON. Yes, this is correct.

Representative VAN ZANDT. Have you any idea how much money we have in the 3 reactors at Hanford right now, the 3 old ones?

Mr. JOHNSON. You mean on capital?

Representative VAN ZANDT. Yes; capital investment.

Mr. JOHNSON. They were built at a cost of about $45 million, as I recall, each.

Representative VAN ZANDT. Each?

Mr. JOHNSON. Yes; and that is being depreciated on a 20-year basis. So about three-fourths of it is written off.

Senator JACKSON. What about the K reactors?

Mr. JOHNSON. I don't know just what the accountants did. We were depreciating at one time on a 10-year basis and a few years ago that was changed to a 20-year basis and currently it is on a 25-year basis. Just how much is left undepreciated at the moment, I don't know.

Representative VAN ZANDT. But they did cost about $45 million initially?

Mr. JOHNSON. Yes.

Representative VAN ZANDT. What is the K-type reactor?

Mr. JOHNSON. It cost [classified data]. It was built about 10 years later, so that it had higher construction costs.

(Classified discussion.)

Representative HOLIFIELD. Then we are going into a future in which we are unable to predict actually the weapon needs. It would seem to me you would be taking more of a gamble on the single purpose which would just happen to be closed down if there were some international agreement to curtail production, where if you had the dual purpose you would have the chance of amortizing it out through the value of the power you create because you could continue to run it and dump that power into the grid. Is that not true?

Mr. JOHNSON. The dual purpose does offer the Government a chance to recover its investment which the other one does not.

Representative HOLIFIELD. Also you would be in a position of course—you would automatically accumulate plutonium during that period of time which if world conditions did change would give you a stockpile of weapon material incidentally, would you not?

Mr. JOHNSON. No, sir; that is not quite true. When operated as a power-only plant, we would expect to make the change of the fuel to the oxide-type fuel and increase the exposure [classified data.] We

are not at all sure the quality of plutonium at that exposure would be suitable for weapons.

Representative HOLIFIELD. So you would not have an incidental production of plutonium?

Mr. JOHNSON. We could have by retaining the dual-purpose type of fuel, the metallic fuel. It could be done that way.

Representative HOLIFIELD. Wait a minute. Let me understand you. You would change to an oxide from your original fuel which would produce plutonium and power. You would change that to a different type of fuel which would produce only, you might say, mainly power.

Mr. JOHNSON. We would if we were told there is no need for more weapons grade plutonium.

Representative HOLIFIELD. Then if you needed to go back to weapons, you would remove that fuel and put in the original type fuel?

Mr. JOHNSON. Yes, sir.

Representative HOLIFIELD. So you would not be gambling by nullifying the capacity to go back to plutonium production?

Mr. JOHNSON. No; we could go back any time, or it could be continued.

Representative HOLIFIELD. And if the technological breakthrough was made in the utilizing of plutonium as a fuel on a justifiable basis, you could continue to produce it and use it as a fuel?

Mr. JOHNSON. Yes, sir. May I add one thought, Mr. Chairman, on this?

Representative HOLIFIELD. Yes.

Mr. JOHNSON. Just judging by the way the conversation is going I would like to again emphasize the importance of thinking about the utility industry. If this job should go in the direction of dual purpose, for example, we should keep in mind that the Northwest pool, I think, has somewhere between 6 million or 8 million kilowatts of generating capacity today. Dropping this thing in, you see, would be the equivalent of 10 percent of that So you would or could have a very marked effect on the plans of utilities who are now putting in generating capacity. So I think these factors probably should be kept in mind.

Senator ANDERSON. How rapidly is their load growing now? Very, very rapidly?

Mr. JOHNSON. Yes.

Senator ANDERSON. In 4 or 5 years they could absorb that if they knew that it was coming, couldn't they?

Mr. JOHNSON. It is not my job to so state, sir. I think we have been recommending that the Government consult with the industry that is concerned.

Senator JACKSON. It is a policy question more than anything else, and I might just say this, that we know that, for example, we are running behind, so we are having to get into steam-fired plants for supplemental and to firm up power during the low-water season. In addition, of course, to save line loss. I think it is well to point out that there is a saving here that of course has been computed by Bonneville, if the power which at the present time is being used by Hanford, around 300,000 kilowatts plus or minus.

Mr. JOHNSON. Yes.

Senator JACKSON. Can be shoved right into the plant on the site you obviously save on line cost because you have a loss per mile. And

that is why the Bonneville rate is lower within 10 miles of the dam, for example, than it is beyond that. So that there is a definite need right in that immediate area, based on growth of both the private and the public utilities in the area. They are really making every effort to find every available source of new production, both hydro and steam, to meet the growing requirements of the area. There is no doubt that 4 years from now, when this power might come on the line, there will be a shortage based on predictions of both the private and the public bodies. There is no dispute about the need. This story of course is a national story. As I understand, the utility industry agrees that we are going to double our power requirements in the next 10 years roughly. It has been in the process of doubling.

Mr. JOHNSON. Roughly double in 10 years.

Senator JACKSON. This is the national figure. Of course, you apply that factor to the Northwest and there is no doubt about the absorption.

Senator ANDERSON. I was going to say, if you are going to double in 10 years, adding 10 percent in 5 is not a tragedy.

Mr. JOHNSON. No. I am not saying that it is.

Senator ANDERSON. No. I am trying to reassure myself a little bit, Doctor.

Senator JACKSON. This is a side policy conversation up at the head table here. We are listening to the technicians at the other end. We are not trying to get you involved in policy.

Representative VAN ZANDT. What does Hanford buy now from the outside?

Senator JACKSON. It is using 300,000 kilowatts plus or minus; is that correct?

Mr. JOHNSON. Yes, sir.

Representative VAN ZANDT. From outside sources?

Senator JACKSON. Outside of the grid. So there is no doubt. I mean the 300,000 would be used immediately right on the site. But the point is that they need to have of course a continuing supply, and with the enormous grid that feeds into the Hanford area, if the dual-purpose thing should close down, as it will from time to time, they can cut in on the Bonneville system and the Bonneville system has tremendous flexibility to deal with that kind of situation, whereas other areas might not be able to meet it in the same way. This depends entirely on the integration of your power system in a given area.

Representative HOLIFIELD. Let me ask this question. As I understand this 3–B will produce 700,000. We are using 300,000 now. Assuming we continue to use the old reactors for a time, we are lucky, and they last for a time, then we would need enough kilowatts to run the old ones at say 300,000 and to run the new ones.

Mr. JOHNSON. Yes, there will be some increase in power requirements.

Representative HOLIFIELD. How much will you need to run the two new ones?

Mr. JOHNSON. We don't have a very good answer because it depends in part on whether we use turbines to drive the pumps or whether we use electric motors. In the past few years we have been using electric drives. On the other hand, with this type of reactor if its pressures are high enough, if we cool by generating steam we

might just as well use the steam to directly drive the pumps. There would be some increase, but we can't quote a very good figure.

Representative HOLIFIELD. But there would be an increase?

Mr. JOHNSON. Yes. Mr. Dowis just mentions these are net figures on power. This is over and above any requirement inside the plant. But you were talking about what the requirement would be in the plant.

Representative HOLIFIELD. If you build a new plant.

Mr. JOHNSON. Not dual purpose, but single purpose.

Representative HOLIFIELD. Yes.

Mr. JOHNSON. Most of the power there is consumed by the reactors. It probably averages [classified data] kilowatts each.

Representative HOLIFIELD. At the present time.

Mr. JOHNSON. Yes. The new reactor would take about the same unless we change over to steam drive.

Representative HOLIFIELD. Moving into these new reactors, do you feel that the development of them would contribute to the reactor art, or would you just utilize the same processes that you have used in the past?

Mr. JOHNSON. There will be some contribution to the art. It is limited to the pressurized-water technology. We are not talking about boiling-water reactors. So whatever technology we develop would be limited to the general field of pressurized-water technology.

There is one important contribution that might come out of it, and that is the proving of whether or not a metallic fuel is practical for power production. This has not been proved. Nobody has been interested in trying to prove it, because it is too risky. We would have to do it to produce plutonium. In using metallic fuel for plutonium production as we must, for cost reasons we will incidentally learn whether it is feasible to use it for power production. If it were, there is a chance of getting lower fuel costs for the power.

Representative HOLIFIELD. If this new reactor lasted 35 years instead of 25 years, you would have an appreciable reduction in your costs there.

Mr. JOHNSON. Amortization costs; yes.

Mr. RAMEY. Would the volume production of fuel elements for this reactor and its replacements have an effect on lowering fuel-element cost generally by showing what you could do on more of a volume basis, or possibly even getting them from commercial sources?

Mr. JOHNSON. You are thinking of helping out the power industry?

Mr. RAMEY. Yes. One of the big troubles of the power industry is they are not making enough fuel elements.

Mr. JOHNSON. This would be true if we put in part of the charge on this reactor as power-only fuel elements, oxide elements. Otherwise, it comes back to the point I mentioned earlier that we may make a contribution by showing how feasible or infeasible metallic fuel may be for power-production purposes. This we don't know and the industry does not know.

Representative HOLIFIELD. What is the status of your design study at this time, sir? If this Congress should authorize one of these reactors, are you in a position where you would be ready to move right in and start on it?

Mr. JOHNSON. Yes; I think we would.

Representative HOLIFIELD. Your design is far enough along where you would definitely start contracting for your——

Mr. JOHNSON. No, sir; I think we would definitely, very quickly be placing orders for the long-lead-time items. These are going to be limiting, not the construction, the zirconium tubing, graphite, high-pressure pumps will limit the schedule. The construction work getting into the ground will come later.

Representative HOLIFIELD. That would come later?

Mr. JOHNSON. Yes.

Representative HOLIFIELD. How much do you need the first year in actual proposed funds if one reactor were authorized?

Mr. JOHNSON. I haven't an authentic figure.

Representative HOLIFIELD. That would be fiscal 1959 funds starting July 1 of this year, to July 1, 1959.

Mr. JOHNSON. If you want just a rough guess——

Representative HOLIFIELD. Yes.

Senator JACKSON. Give a rough estimate now and supply for the record later more detailed estimates, Mr. Chairman.

Mr. JOHNSON. And we are talking about either the single-purpose or convertible reactor, and let us say your are talking——

Senator ANDERSON. You are talking about convertible, let us say.

Mr. JOHNSON. I would guess $50 million for the first year.

Representative HOLIFIELD. Let us assume we are talking about the 3–B reactor. Would that be the same?

Mr. JOHNSON. No; I think we would there have to make commitments on condensers, things of this sort, that might involve progress payments and that would add to the figure. I don't know just how much. There is quite a lot of stainless-steel equipment and the turbines, the generating equipment is one of the longest lead time—the turbine equipment is one of the longest lead time items in the program.

Senator ANDERSON. If the approval was given for the construction of one reactor, you do want to order these zirconium tubes and things of that nature?

Mr. JOHNSON. Yes.

Senator ANDERSON. If later on you decided to go ahead with the 3–B, which I understand you are going to wait on anyhow, you would be satisfied with the $50 million as you now see it? You are going to supply the figure, but that would get you under way; would it not?

Mr. JOHNSON. Yes.

Senator ANDERSON. If going ahead with the actual plant you would need time for stainless steel and those things. How much more time would you need? Should they be ordered in the same fiscal year or would they be ordered in the 1960 fiscal year?

Mr. JOHNSON. Are we still talking about the convertible plant?

Senator ANDERSON. Yes. I am just trying to see if we need to try to go further than, say, $50 million. You have said if going into 3–B, which has a very attractive price tag on it and looks like the ultimate plan, you indicated as a matter of prudence you would want to go a little slowly, and I fully subscribe to that. I think that is a fine point of view. Is there a need to order the stainless steel and make the progress payments during the 1959 fiscal year?

Mr. JOHNSON. In the event 3–B were authorized?

Senator ANDERSON. Yes.

Mr. JOHNSON. There might be, depending on how urgent your schedule is. This is a matter of getting into the mills, getting into the mill schedules. Right now we would not have much trouble.

Senator ANDERSON. Now you have me worried. I understand if you started with a convertible that you could subsequently switch it to something else.

Mr. JOHNSON. Right.

Senator ANDERSON. Do you need to order the "something else" now?

Mr. JOHNSON. No, sir.

Senator ANDERSON. Therefore, if you started with the $50 million, it would see you through the 1959 fiscal year?

Mr. JOHNSON. That is right.

Senator ANDERSON. And if you had to go into stainless steel you would know that by maybe next January or February, and could come in and say it is time to start looking ahead.

Mr. JOHNSON. I think any time the decision was made you wanted to go dual purpose, there is about 4 years to wait after that decision is made to get the equipment in.

Senator ANDERSON. Maybe I have not asked the question right. Supposing we said to you today we knew we wanted the dual purpose and AEC agreed and everybody agreed we wanted dual purpose eventually. You would still start with the convertible as a matter of prudence.

Mr. JOHNSON. Yes, sir; but we would also in that case be placing the orders for turbines and other equipment and would need more than $50 million in that case.

Senator ANDERSON. As I understand it, you would need additional money for progress payments. On turbines would any construction take place in 1959 fiscal year?

Mr. JOHNSON. No, sir; I don't think so.

Senator ANDERSON. I mean on those items.

Mr. JOHNSON. The manufacturers would undoubtedly be ordering materials, yes.

Senator ANDERSON. And they have to have progress payments.

Mr. JOHNSON. And be doing some building.

Senator ANDERSON. They would be ordering but not receiving. Do we have to pay in advance? We are about to give $4 million worth of material to EURATOM and they are not going to pay anything for 10 years.

Mr. JOHNSON. I don't know just how much they would need in the way of progress payments or what the deal would be. It would take us about 6 months to get the design firmed up, the material out for bids, bids evaluated, before we could place any orders.

Senator ANDERSON. The Congress will be out of session in August we hope until next January. You would not be handicapped any by having to wait until next year and probably getting through an emergency bill?

Mr. JOHNSON. No.

Senator ANDERSON. So if $50 million or $60 million was carried, you would not suffer?

Mr. JOHNSON. I don't think so.

Senator ANDERSON. You can supply us with a later schedule on it. This is a pretty harsh thing to ask you to do, to supply out of thin air. I think the committee would like to have it.

Mr. JOHNSON. Yes.

Representative HOLIFIELD. Yes.

Mr. JOHNSON. I think it would be a good guess.

(Discussion off the record.)

Representative HOLIFIELD. Mr. Vance, would you care to comment in any way on the statement that has been offered this morning?

STATEMENT OF HAROLD S. VANCE, COMMISSIONER, ATOMIC ENERGY COMMISSION

Mr. VANCE. Only to this extent, Mr. Holifield. With regard to the different types of reactors listed here on the board, I think that our technical people feel as Mr. Johnson has stated, that the safer and not only the safer course, but the better course is to proceed in two stages as contemplated by 1–B (the convertible type reactor). Not only will we have the additional time to perfect the new type of fuel element, which has to be perfected as Mr. Johnson emphasized, we will get plutonium out of this new reactor quicker by that method. I emphasize the latter point because of the consideration we have given to the necessity for having additional plutonium capability.

Senator ANDERSON. You have spent a good long time in industry. If you had a ball-bearing plant that you knew would wear out in 5 years, would you wait until the fifth year to start to replace it, or would you start to replace it—if it took you 5 years to get a new one built, you would start replacing it immediately, would you not?

Mr. VANCE. I am not talking about delaying the construction of the plant, Senator; only about which road we should take.

Senator ANDERSON. I agree with you completely. I am only saying as I understand Mr. Johnson, it will probably take 4 years to get this reactor built.

Mr. VANCE. To get it into operation.

Senator ANDERSON. We have been told the life of these reactors might be another 5 years. It is a hazard as to how many. It could be 10, but might be only 5. You know it is going to take 4 years to get something built. Isn't it about time to get it underway?

Mr. VANCE. I think so.

Senator ANDERSON. That would be the prudent way.

Mr. VANCE. I think so.

Representative VAN ZANDT. Does the Commission concur in the statement of Mr. Johnson that the life of the reactors at Hanford is about 5 years?

Mr. VANCE. I would like to ask our Director of Production to answer that question.

Mr. BLOCH. Actually the life is indeterminate. I think on the basis of information we have been receiving, what we are apt to encounter is——

Representative HOLIFIELD. You are Mr. Bloch?

Mr. BLOCH. Yes.

Representative VAN ZANDT. Let me put the question again. Does the Commission concur in the statement of Mr. Johnson that the life of the original reactors especially at Hanford is 5 years?

Mr. BLOCH. We have been assuming that we could get a total of about 25 years' useful life out of them. We recognize that there are risks attendant to this; that it is indeterminate, in the sense as each year goes along, you learn something more. A useful life of 25 years would run the existing reactors for about another 10 years from now.

Senator ANDERSON. What was your first estimate of useful life?

Mr. BLOCH. The first estimate?

Senator ANDERSON. Yes.

Mr. BLOCH. I guess the estimate preceded my being in Production, but the first estimate back in 1947 or so was that they might last only a few years. The problem that generated that estimate was solved.

Senator ANDERSON. Now, having solved that, did they next put it on a 20-year basis?

Mr. BLOCH. I think our feeling was that these plants were an experiment that we could forecast several years ahead at which time they might deteriorate to the point where we would have real trouble.

Senator ANDERSON. Actually they depreciated on 5 percent or 20-year basis, didn't they?

Mr. BLOCH. Yes. For accounting purposes at 1 time they were 20. Currently they are 25. Senator, we have just completed a reworking of these older reactors to increase their capability. [Classified data.] Work on the last reactor was completed last summer. While this was done primarily to get more production, it did result in replacing a water system with new equipment.

We have been through a retubing program. It seems that the things that are really questionable are the life of the graphite and the life of the shielding, thermal shielding.

Senator ANDERSON. If they are costing you [classified data] for plutonium and you could make it for much less, that might change the useful life, might it not?

Mr. BLOCH. It is a question of how many years it would take to recover your new capital investment on the replacement.

Mr. JOHNSON. Mr. Chairman, I am afraid that there was some different construction put upon my remarks than intended. The statement that I made that they would last 5 years was intended in the sense that I would expect them to last at least 5 years. Beyond that it is somewhat indefinite.

Representative HOLIFIELD. I think we understand that.

Chairman DURHAM. Beyond that was a hazard.

Representative VAN ZANDT. That is right.

Chairman DURHAM. Pursuing the point you brought up in the differential in the cost of plutonium, which if we continued to operate for 10 years, and they do operate 10 years, they are getting plutonium out at [classified data]. Now, I don't know how much production we have over the next 10-year period, but—was this a year——

(Classified discussion.)

Chairman DURHAM. You multiply that by 10 and take the differential in your cost and you have a sizable item here.

Senator ANDERSON. Exactly. That is what I was trying to get to. I thought Mr. Vance would be the first one to say while you might

be able to keep a body plant going another 15 years, it might be so costly you could not afford to do it.

Mr. VANCE. That is right.

Senator ANDERSON. And you change it around in order to take advantage of the automation and a lot of other things. It could be. I don't say it is because I don't know, but it could be the situation out there that the savings would make this plant attractive to you. At least finding out if the savings existed would be desirable.

Chairman DURHAM. You take and calculate that over a period of 10 years if we continue to have the necessity to get plutonium, which I am not much worried about, because I think we will, myself. I think those figures would be significant to the committee. I think the staff can work that up.

Representative VAN ZANDT. May I ask Mr. Bloch a question?

How much money did we put into these old reactors at Hanford to bring about this program you mentioned a moment ago?

Mr. BLOCH. Cost of work on the older reactors I believe was on the order of about $9 million or $10 million for each reactor. We had a program totaling about $40 million which involved work actually on 5 of the reactors; the 3 old ones and some of the newer ones. I think costs were around $10 million apiece.

Representative HOLIFIELD. Dr. Libby, would you have anything to add?

Mr. LIBBY. I pretty well agree with what Mr. Vance has said. I think either A or B looks like a pretty good deal.

I see the point Mr. Durham makes very clearly. If we have a continuing need for plutonium for 10 years, this is going to make the additional reactor at Hanford particularly desirable. Whether you want to go for the 700,000-kilowatt job in the present state of the art is another question. But I think 1–B (the convertible type) is a pretty safe bet.

Senator ANDERSON. Could you tell us what the Commission asked the Bureau of the Budget for?

Mr. LIBBY. 1–A.

Representative VAN ZANDT. For plutonium only?

Mr. LIBBY. Plutonium only.

Senator ANDERSON. Would there be serious objection to asking for 1–B insofar as you know on the part of the Commission?

Mr. LIBBY. Not on my part; no.

Senator ANDERSON. How about you, Mr. Floberg?

Representative HOLIFIELD. Mr. Floberg left.

Senator ANDERSON. How about you, Mr. Graham. Do you feel 1–B would be an unreasonable request or a desirable request?

Mr. GRAHAM. Senator, you have me in something of a technical switch here, if I can put it that way. I have heard a lot of talk over the period of time since I have been here about whether you should or should not have a dual-purpose reactor. I think the people can march up the hill and back down again and leave me standing. It depends upon what expert you are talking to. We were addressing ourselves primarily to the point of being satisfied in our own minds that we needed to stress the plutonium. After hearing Dr. Johnson here this morning, and with deference to my learned colleague, Dr. Libby, at this point in time if I had to go ahead and vote. I think I would say I would just as soon go for 1–B and let us see where we go from there.

Senator ANDERSON. I did not think Dr. Libby was hostile to 1–B. I thought he was very frankly favorable to it.

Mr. GRAHAM. I said, in bowing to the knowledge of my learned colleague, Dr. Libby, on the question of 1–B, if I were forced to vote this morning on this question, I think I would go along with 1–B. I am just trying to tell you that the main consideration that we had when we were discussing this was on the basis of plutonium. This is what we were trying to get at and get our hands on. I am just trying to show you the qualifications I have considered.

Senator ANDERSON. I think we all have. I think it was very interesting to hear Mr. Johnson say he thought a prudent way would be to start with 1–B, I was very happy, Mr. Vance, Dr. Libby, and now you agree that would be prudent. It strikes me that way too. I was hopeful whatever the Congress tried to do, maybe something that the Commission would feel it would like to do.

Mr. VANCE. A question was asked a moment ago of Dr. Libby, which one of these types we discussed with the Bureau of the Budget and he said 1–A.

Senator ANDERSON. Yes.

Mr. VANCE. I would like to explain why. When the GE report came to the Commission on the 1st of March, and at the time we first discussed this matter with the Bureau of the Budget, 1–B was much less firm than it is today. We did not have the field figures on 1–B. Therefore, at that time it was largely a choice between 1–A and 3, and as between those two we discussed with the Bureau 1–A. I think if we had had all this information today the discussion would have been on the basis of 1–B and not 1–A.

Senator ANDERSON. That is very helpful.

Mr. VANCE. I wanted to explain that for the record.

Representative VAN ZANDT. Mr. Chairman, may I ask Mr. Vance this question: How much money did you ask from the Bureau of the Budget to cover 1–A?

Mr. VANCE. I think $125 million; approximately that.

Representative VAN ZANDT. And they deleted the item entirely; did they not?

Mr. VANCE. That is correct.

Representative VAN ZANDT. In other words, they did not allow a penny.

Mr. VANCE. Yes.

Mr. VANCE. I think it only fair to say the reason why the Bureau deleted the item was because we could not produce the military requirements for it. We requested such requirement from the DOD and were unable to get it.

Senator ANDERSON. I think you never will be able to produce military requirements. They are not working 5 years ahead and do not understand the problem Mr. Johnson has in saying he can fairly well guarantee 5 years of operation and maybe be able to guarantee 10, and maybe able to guarantee 15. He would like to look at what he is reasonably sure of, and I think the Commission was right in saying we also want to be reasonably sure. But the military says we have enough for next year, and believe we have enough for the year following.

Chairman DURHAM. Did they commit themselves to a massive missile program, though.

Senator ANDERSON. They surely did.

Representative VAN ZANDT. And asked for $200 million to buy plutonium abroad.

Representative HOLIFIELD. I was going to say although they had no military requirement and turned you down on your proposition all because there was no military requirement, yet they did ask for a fund of $200 million predicated upon the fact while there was no military requirement that the DOD had reluctantly admitted they could use it.

Representative HOLIFIELD. Are there any further questions? Does the staff have any questions?

Senator ANDERSON. I think it has been a very useful session. I not only commend Mr. Johnson, but the members of the Commission for giving us this information I think it is fine.

Chairman DURHAM. It is excellent.

Representative HOLIFIELD. The committee will stand adjourned at this time.

(Thereupon at 12:15 p. m. Monday, June 9, 1958, the executive session was concluded to reconvene in open session, Tuesday, June 10, 1958.)

AEC AUTHORIZING LEGISLATION

TUESDAY, JUNE 10, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to call, at 10 a. m., in room 457, Senate Office Building, Hon. Chet Holifield (chairman of the subcommittee) presiding.

Present: Representatives Holifield, Durham (chairman of the Joint Committee), Van Zandt, and Senator Jackson.

Also present: James T. Ramey, executive director, David R. Toll, staff counsel, Joint Committee on Atomic Energy, and Bernard V. Dvoskin, GAO consultant.

Representative HOLIFIELD. The subcommittee will be in order.

The Subcommittee on Legislation of the Joint Committee on Atomic Energy is meeting in public session today to continue hearings on AEC authorization bills, H. R. 12458 and H. R. 12459.

Our first witness this morning is Senator Estes Kefauver, of Tennessee, who has requested to appear before the subcommittee to testify concerning a project deleted from the bill by the Bureau of the Budget, namely $6,500,000 for a metals and ceramics research building at Oak Ridge National Laboratory in Tennessee.

Following Senator Kefauver, we are scheduled to receive testimony from representatives of the AEC concerning the AEC power demonstration program. By H. R. 12458, the AEC is requesting approximately $4 million increase in funds for existing projects in the power demonstration program, permission to waive charges for heavy water in reactors other than natural uranium reactors, and specific authorization of funds for use in proposed arrangements No. 58–111–5 (the Florida Group project) and 58–111–6 (phase I) (Pennsylvania Power & Light project).

The staff of the Joint Committee, in accordance with my instructions, last week also notified Pennsylvania Power & Light Co. and Westinghouse Corp. concerning this morning's hearings and representatives of these companies are also present in the room and may testify before the subcommittee following the Commission's presentation, if they care to do so.

If time permits this morning, or if not this afternoon, the subcommittee will then consider section 109 of H. R. 12459. In this section 109 the AEC requests authorization of an additional $20 million for additional proposals not yet received in the power demonstration program and $4,309,000 for the Power Reactor Development Co. project.

As I stated earlier, our first witness this morning is Senator Estes Kefauver, of Tennessee. We are very glad to have you with us this morning, Senator. Would you please proceed with your statement.

STATEMENT OF HON. ESTES KEFAUVER, A UNITED STATES SENATOR FROM THE STATE OF TENNESSEE

Senator KEFAUVER. Thank you very much, Mr. Chairman. I appreciate this opportunity of being heard. It is a privilege to appear here today in support of basic research in atomic energy.

I am familiar with fine work that has been done by you, Mr. Chairman, and that this committee is doing and has done in the past in support of basic research. The people of the United States are much indebted to you for your efforts. The Atomic Energy Commission is in great need of another facility at Oak Ridge National Laboratory which is directly related to the reactor development program which I understand the committee now has under consideration.

The Atomic Energy Commission, in its estimate of needs and in its testimony here of May 14, has proposed the construction of a metals and ceramics building at Oak Ridge for the purpose of doing research on various metals and materials which may be used in power reactors.

At present the facilities for this work are limited and entirely inadequate. Personnel are scattered around Oak Ridge. They are housed in temporary buildings which are unsuited for the purposes for which they are being used.

I have had the opportunity of going around and seeing the conditions under which they work, personally. Considerable time is lost in just coordinating the efforts of the research workers. The workers are forced to work under substandard conditions which seriously retard their efforts. Research workers are repelled from working for the Government when the physical facilities are so poor.

A metals and ceramics building would provide much-needed information on the behavior of metals and other materials when subjected to neutron radiation. As I understand it, and I do not claim to have expert knowledge in this field, little is known and certainly more needs to be known, about the reaction of these metals under such conditions.

Information on the reaction of these metals would contribute greatly to reactor development since these metals may find use in the power reactors which we are now striving to develop for aircraft and for the production of power.

I am informed that the reactor development program has been seriously impeded by the lack of knowledge regarding these materials and that much faster progress could be made if this information were available.

This research, I might add, has significance in both the military and peacetime applications of atomic energy.

The construction of this metals and ceramics building would cost a total of $6.5 million according to recent estimates by the Atomic Energy Commission.

I was talking to Dr. Libby, and I believe that was the right figure. The Commission did not even submit this proposal to the Bureau of the Budget because it was felt that there was no hope for its consideration owing to the prevailing attitude at the Bureau.

I feel very strongly that the Bureau of the Budget should not interpose its judgment in matters where the security of the Nation is involved and where it has no real competence.

According to my information the Atomic Energy Commission considers this building of critical importance and I believe that the Congress and particularly this committee should be given opportunity to consider it. I sincerely hope that the committee will do so and that it will include the metal and ceramics building at the Oak Ridge National Laboratory in its authorization bill.

Mr. Chairman, my colleague, Senator Gore, who is a distinguished member of this committee, but who unfortunately had to be in Tennessee today, and I have talked many times about this. He has read this statement also. He has perhaps told you, Mr. Chairman, as he has told me that he agrees with this conclusion.

He has more information about it, certainly, than I do. Also, Congressman Howard Baker, the Congressman from the Second District of Tennessee, in which Oak Ridge is located, has studied the matter, and he joins in this request also.

Representative HOLIFIELD. The chairman is aware of the interest of these two gentlemen in this project. I would call to the attention of the Senator the fact that Congress approved for buildings of similar types, physics, engineering, engineering and research buildings in the 1957 appropriation, one of which was in Oak Ridge, not this particular building but a different one, and the Bureau of the Budget has so far refused to use the authorization or the appropriation for those buildings.

I think the committee looks with favor upon this particular project because there is nothing any more important than research in metals and ceramics at this time.

This is one of the very key points of future development of this technology. But we are not assured that even if we write this item into the bill, that the Bureau of the Budget will not act as it has in the case of the other four buildings and hold up the expenditure of the money.

Senator KEFAUVER. I am certainly glad to hear your opinion, Mr. Chairman, as to the need for this research and the importance of this research, and having facilities to do it.

You are a great expert on this subject. I want to reiterate that this is a matter of tremendous importance in the defense of the United States and in the future peacetime use of atomic energy. I do not know that the Bureau of the Budget has any special scientific and technical knowledge on the subject. I would hope that this commitee on this occasion, as it has in the past, would move to keep us ahead in these fields, regardless of the attitude of the Bureau of the Budget, particularly when the need is backed up and sustained by the very able members of the Atomic Energy Commission.

Representative HOLIFIELD. The Senator's statement may be in error on page 2 where he says that the Commission did not submit this to the Bureau of the Budget because it felt there was no hope for its consideration.

It is the understanding of our staff that this was submitted to them and was turned down. I may be in error. If I am in error, you may correct me, Mr. Libby.

Dr. LIBBY. That is correct.

Representative HOLIFIELD. You did submit the project.

Dr. LIBBY. Yes, sir; we did.

Representative HOLIFIELD. And, Dr. Libby, the Commission did feel that this was a valuable and necessary expenditure?

Dr. LIBBY. We felt very strongly about it.

Senator KEFAUVER. I didn't understand, Dr. Libby, that it had been formally submitted. I understood that the matter had been discussed with the Bureau of the Budget rather informally, and that they did not go for it at the present time. Was there a formal submission?

Dr. LIBBY. Yes, sir.

Senator KEFAUVER. I am glad to know that, and I am very happy to correct the statement that is contained here.

Mr. Chairman, I feel that this administration has not yet fully recognized the need for pursuing basic research. Although there has been considerable awareness of the tremendous challenge that the Soviet Union and other nations are making in both the military and peacetime applications of atomic energy; although we have begun to discern the great economic benefits that are to be derived from further technological development in atomic energy, it is evident that the administration has been unwilling to invest sufficient money and effort in the necessary research which will provide for these benefits.

While the President appoints his own scientific advisers and an adviser on science to the State Department, the Bureau of the Budget continues to deny funds to agencies performing critical experimentation in atomic energy and other research fields.

I feel that we must somehow remove this roadblock that the Bureau of the Budget has established and pursue our scientific objectives at full speed.

I have had brought to my attention recently an example of this obstruction by the Bureau of the Budget at Oak Ridge, Tenn.

This is what you were referring to, Mr. Chairman, the fact that four buildings were approved in 1956 and appropriated for but money was diverted to other purposes.

In 1956, the Joint Committee, as you have stated, proposed and the Congress authorized the construction of permanent research buildings at Oak Ridge National Laboratory, at Brookhaven, and the University of California, and one other, I believe.

Funds were appropriated for their construction. The Bureau of the Budget, however, diverted these funds to other purposes and left the Atomic Energy Commission without sufficient funds to provide for these facilities. At recent hearings before this committee, Dr. Libby testified that these facilities "are of pretty high priority." He also stated that the AEC "reluctantly concurred" in the decision of the Bureau of the Budget not to request funds for these permanent Research buildings again in fiscal year 1959.

In conclusion, may I add that I have written the Director of the Bureau of the Budget a letter urging him to reconsider his decision to defer requests for funds for the permanent research buildings at Oak Ridge?

I would like to ask unanimous consent that my letter of May 28 to the Director of the Bureau of the Budget be printed following my statement.

Representative HOLIFIELD. The letter will be received.

Senator KEFAUVER. I have not yet received a reply from Mr. Stans, the Director of the Bureau of the Budget.

I intend to request the Appropriations Committees to include funds for these projects in the budget for fiscal year 1959.

I certainly hope that this subcommittee and the Joint Committee will make such a request, and I feel that the Appropriations Committee would go along with it if such a request were made. I am certain that the committee recognizes the vital importance of those facilities and will give support to their completion.

May I again express my hope that the committee will also give favorable consideration to the construction of the metals and ceramics building at Oak Ridge and include it in your authorization for fiscal 1959.

(The letter referred to follows):

MAY 28, 1958.

Mr. MAURICE H. STANS,
Director, Bureau of the Budget,
Washington, D. C.

DEAR MR. STANS: I am deeply concerned about the inability of the Atomic Energy Commission to develop fully its research potentialities at Oak Ridge, Tenn. It recently came to my attention that funds for a permanent research building at the Oak Ridge National Laboratory have been diverted by the Bureau of the Budget for use elsewhere, resulting in a serious crippling of the research program there.

I hope that the Bureau of the Budget will reconsider its action in this matter. The facilities for basic research at Oak Ridge are totally inadequate. They are scattered over a wide area, requiring a considerable amount of time to be spent in just getting from one section to another. The research personnel are working in temporary buildings which are not suited to their purposes and often impede seriously the prosecution of the research work. Qualified research workers are repelled from such an installation operating under substandard and sometimes impossible conditions. The Atomic Energy Commission stated in justification of this project: "The existing space situation at ORNL is very critical and adequate permanent facilities should be provided as soon as possible."

In recent hearings before the Joint Committee on Atomic Energy, Dr. Libby stated that the Atomic Energy Commission "reluctantly concurred" in the decision by the Bureau of the Budget to defer a request for funds for this project at Oak Ridge until after fiscal 1959. He did this in spite of the fact that in his opinion that "these facilities are of pretty high priority."

In view of the desire of the Atomic Energy Commission to proceed with the construction of this facility and the expressed will of Congress in authorizing the project and providing funds for its fulfillment I hope that you will take steps to include this research facility in the budget request for the Atomic Energy Commission for fiscal year 1959.

Sincerely,

ESTES KEFAUVER.

Representative HOLIFIELD. Thank you, Senator, for your statement. While the Chair cannot predict the action of the subcommittee in regard to this particular item, I can assure the Senator that the subcommittee as a whole is very much aware of the importance of the research and development and this particular item, and the Chair hopes personally that it will be included in the authorization bill and that the Commission will push forward to putting this into construction.

Senator KEFAUVER. I am certainly glad to hear this attitude on behalf of the chairman expressed.

Representative HOLIFIELD. The same feeling applies, incidentally, to the four we have already appropriated for, which the Budget Bureau is holding up.

Senator KEFAUVER. It does not look exactly right to me that where the Atomic Energy Commission says it needs facilities, this Joint Com-

mittee after a full study says it needs these buildings, and the Appropriations Committee and the Congress says so—I believe the total amount of the four buildings was somewhere in the neighborhood of $8.5 million or $9 million—that the Bureau of the Budget would put its judgment over and above that of all the groups that have some special knowledge and competence, and who have responsibility for this program.

Representative HOLIFIELD. The four buildings are the permanent research building at Oak Ridge National Laboratory, $5,780,000; the physics building at Brookhaven, $2,140,000; the engineering building at Brookhaven National Laboratory, $1,879,000, and an engineering service building at the University of California Radiation Laboratory for $1,080,000. Those have already been authorized and are the ones that are being held up by the Budget.

Thank you very much, Senator, for your statement.

Senator KEFAUVER. Thank you very much, Mr. Chairman, and gentlemen.

(Subsequently the Joint Committee received the following letter from Congressman Evins, regarding the proposed metals and ceramics building at Oak Ridge.)

CONGRESS OF THE UNITED STATES,
HOUSE OF REPRESENTATIVES,
Washington, D. C., June 19, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
House of Representatives, Washington, D. C.

DEAR CHAIRMAN DURHAM: I should like to renew my interest in the proposed Metallurgical and Ceramic Research Laboratory at Oak Ridge, Tenn.

It is my understanding that the Atomic Energy Commission, in its budget for 1959 submitted to the Budget Bureau, asked for $6½ million for the construction and operator of this Laboratory. I understand, also, that the Budget Bureau disallowed this item of the Atomic Energy Commission budget, among others.

I should like to express the hope and to urge that the Committee will reconsider this request by the Atomic Energy Commission and authorize this program for the coming year. The Atomic Energy Commission considers that the proposed research activity is of great importance. The Commission is prepared to go forward with this program and has the facilities to do so. Certainly, I believe that, in scientific and technological matters like this, the opinions and judgment of our experts and scientists should hold precedence over those of the Budget Bureau. Therefore, I urge the committee to give favorable consideration to the inclusion of the Metallurgical and Ceramic Research Laboratory in the authorizations for the coming year.

With kindest regards and best wishes, I am,

Very sincerely yours,

JOE L. EVINS,
Member of Congress.

Representative HOLIFIELD. Mr. Vance or Mr. Libby, whichever one of you gentlemen are going to speak for the Commission this morning, we have before us H. R. 12458, which seeks to raise construction funds from $129,915,000 to $133,863,000, and also add a waiver of use of heavy water.

STATEMENTS OF COMMISSIONER HAROLD S. VANCE, COMMISSIONER W. F. LIBBY, AND COMMISSIONER JOHN S. GRAHAM, ATOMIC ENERGY COMMISSION; ACCOMPANIED BY W. K. DAVIS, DIRECTOR OF DIVISION OF REACTOR DEVELOPMENT; DELMAR MORRIS, ASSISTANT DIRECTOR OF DIVISION OF REACTOR DEVELOPMENT; DON BURROWS, CONTROLLER; FRANK McCARTHY, ASSISTANT CONTROLLER FOR BUDGETS; A. TAMMARO, ASSISTANT GENERAL MANAGER FOR RESEARCH AND INDUSTRIAL DEVELOPMENT; L. OLSON, GENERAL COUNSEL; AND ROLAND A. ANDERSON, CHIEF, PATENT BRANCH, OFFICE OF GENERAL COUNSEL

Representative HOLIFIELD. Would you please explain this, whichever one of you wishes to speak for the Commission this morning, and give us the information on these items?

Dr. LIBBY. I think probably we had better call on Mr. Davis as the prime source of information, Mr. Holifield.

Representative HOLIFIELD. All right, Mr. Davis, you may proceed.

Mr. DAVIS. The first item is the request for the waiver of the use charges for heavy water for all of the reactors which would be eligible for assistance under the Commission's power-demonstration program.

Representative HOLIFIELD. How much does that amount to?

Mr. DAVIS. It amounts to $950,000 for the Pennsylvania Power & Light, Westinghouse Corp. proposal, and $420,000 in the case of Carolina-Virginia's proposal.

Representative VAN ZANDT. Give us those figures again, please.

Mr. DAVIS. They are $950,000 for Pennsylvania Power & Light-Westinghouse, and $420,000 for Carolina-Virginia's, and this request is a part of the Florida item for the waiver for heavy water which would be $450,000. The total would be $1,820,000, if I have added it correctly.

Representative HOLIFIELD. That is the waiver part.

Mr. DAVIS. This is a waiver of the use charge. It is not a waiver of the charges which might arise due to loss or due to dilution of the heavy water or things of that sort, which would be paid by the proposers.

Representative HOLIFIELD. In other words, this waives 4 percent upon the inventory value of this material?

Mr. DAVIS. That is correct.

Representative HOLIFIELD. And any loss as a result of use in the inventory must be paid for at the regular rate of our heavy water sale price?

Mr. DAVIS. That is correct; yes, sir.

Representative HOLIFIELD. Mr. Toll?

Mr. TOLL. Mr. Davis, is it correct that at the time the Commission announced the third round, it was specified that the waiver of heavy water use charges would be offered for natural uranium reactors, and this additional authority is required because these reactor projects are not to use natural uranium but slightly enriched uranium, and, therefore, the ground rules, so called, are being changed to that extent?

Mr. DAVIS. That is exactly correct, Mr. Toll.

Mr. TOLL. Are these other projects besides these two that will use heavy water, or not?

Mr. DAVIS. There are not any that we have under consideration at the present time, but I think our feeling is that almost any reactor that might be likely to be proposed, even though it might be one that was operable on natural uranium, would probably contemplate also operation with some enrichment. So I think this is a very necessary step.

Representative HOLIFIELD. What would the inventory value of that amount of heavy water be?

Mr. DAVIS. This is for 5 years waiving 4 percent, so it would be roughly 5 times the amounts I have quoted, if I have done the mathematics in my head correctly. It is something of the order of $9 million.

Representative HOLIFIELD. $9 million.

Representative VAN ZANDT. Doctor, what this amounts to is a loan, does it not, with the recipient covering the cost of heavy water they use?

Mr. DAVIS. That is correct, Mr. Van Zandt, yes, sir.

Representative HOLIFIELD. This is further confession by private industry that it needs additional Government subsidy, and this is not to be considered as socialism, is it?

Mr. DAVIS. I wouldn't say so, no, sir.

Representative HOLIFIELD. All right. I just want to have that considered in the record, because we want to be very careful, you know, not to do anything socialistic. Now will you testify to the $4 million difference in the principal sum?

Mr. DAVIS. I believe you have the analysis of the proposed amendments and the reconciliation of the two sums as shown on pages 1 and 2 of this, under amendments to section 111 (a) of Public Law 85–162. There are a number of changes here. I could go through them individually if you like.

Representative HOLIFIELD. Yes. Let's do that. Do you have a list there with consumers as the first item?

Mr. DAVIS. Yes.

Representative HOLIFIELD. That is an $8 million, unusual maintenance and fuel cycle cost.

Mr. DAVIS. Did you wish to consider the differences or each item individually?

Representative HOLIFIELD. No, the differences. You have no difference in the total amount there, but I did want to ask you the question on that $8 million item. That is postconstruction cost, as I understand it, but why is it that this authorization is needed at this time for this amount?

Mr. DAVIS. Well, this is a part of the contractual arrangements and was needed in order to be able to enter into the contemplated contracts. What this provides for is a reserve fund in case there are some major replacements or alterations that are needed to the plant, and then for excess costs of the fuel cycle over and above the amount which we have agreed with them, which is in terms of a certain fixed number of dollars per kilogram of fuel for the overall fuel cycle.

Representative HOLIFIELD. We waived this last fall, didn't we?

Mr. MORRIS. Yes, sir. We had a hearing before your committee on September 17. You subsequently waived the 45 days. We have entered into a contract with Consumers which provides for the amount shown. There is no change. We are showing them in this tabulation for completeness and comparison.

Representative HOLIFIELD. This authorization is sought as a matter of completing your arrangements, and you will not, of course, ask for the money for this until it is needed?

Mr. MORRIS. This money was available or has been available in 1958 and it was obligated when we signed the Consumer's contract last fall.

Mr. DAVIS. The first item in which there is a change is in the Elk River item. These others are unchanged from last year.

Representative HOLIFIELD. This is a recap, then?

Mr. DAVIS. This is a recap to show where the $4 million difference in the amounts comes from.

Representative HOLIFIELD. This is not a line item. The Elk River change would be a line item, would it not?

Mr. DAVIS. These are changes in the total, Mr. Holifield, and this table is to show how we arrived at the totals, where the differences arise. The total itself is a line item.

Mr. TOLL. The existing total in the act is $129,915,000, and this bill would increase that amount by approximately $4 million, to $133,863,000.

Mr. DAVIS. That is correct.

Mr. TOLL. So this chart that you have provided gives a breakdown of that new total.

Mr. DAVIS. Yes. This is backup information to show where the total comes from.

Representative HOLIFIELD. Then the testimony should concern itself with the differences, with the increases, I suppose. The Elk River shows the first increase of about $800,000.

Mr. DAVIS. That, of course, is a result of the change in the contractor, in the negotiation of a new contract for this plant.

Representative VAN ZANDT. Is there anything in this amount representing increased cost of construction?

Mr. DAVIS. Yes, I believe this would represent an increased cost of construction, basically.

Representative VAN ZANDT. What does it amount to, percentage-wise?

Can you estimate it? This represents a period of a year, does it not?

Mr. DAVIS. It is a change in the contractor, and in this particular contract the cost is more in the construction and somewhat less in the research and development. I would not really know quite what figure to compare it with previously since that cost figure, as you recall, was changing fairly rapidly last year.

Representative VAN ZANDT. I think this in substance represents the difference between the so-called buying in of the original contractor and the fact that the present contractor is not buying in for a certain sum, does it not?

Mr. DAVIS. We have no knowledge of what any buy-in would be on either contract.

Representative HOLIFIELD. The original supplier was going to put some money into it.

Mr. DAVIS. The original supplier originally had a very low price. As you recall, then, it increased in several steps, and in some of the steps there may have been some absorption of cost.

Mr. RAMEY. Isn't that the definition of buying in, coming in low and then increasing in steps?

Mr. DAVIS. Well, I think it depends on whether you think you are buying in or whether you think it is an accurate estimate.

Representative HOLIFIELD. We have a letter here dated September 18, 1957, from Morehead-Patterson, the American Machine & Foundry Co. In his letter he announced that the increase in price was resolved on 3 major factors, 1 of which was the risk of losses if the company exceeds substantially the million dollar contribution which they propose to make to this project, and which, in fact, they have already invested.

Let's go to the next item of difference, then.

Mr. DAVIS. The next item is the elimination of Wolverine which had been in at $5,472,000. On Piqua, the increase here is approximately $1.5 million, represents the renegotiation of the contract terms for the construction of this plant.

Representative HOLIFIELD. Before we leave the Wolverine, you might state for the record exactly what happened on that project.

Mr. DAVIS. This was a project on which we originally had had a fixed price for the construction of the plant, but when we came to try and make this firm the price which originally had been a total, I believe, of about $5 million, was increased, if I recall correctly, to about $14 million, as an estimated cost and not as a ceiling. We then asked Oak Ridge to review the project and to make estimates of the cost. These came out to be very high. Furthermore, they gave us pretty good evidence that the cost in terms of dollars per kilowatt for a plant of this type probably could not be reduced very much even in the future, and the Commission therefore decided to terminate this particular project.

Representative HOLIFIELD. Mr. Keane, in testifying before us last year, on last year's authorization, said that they had a firm contract, although it had not been signed, that they had a firm contract offer. We were under the impression that that was going ahead. Then about the time Congress adjourned or immediately thereafter—I guess it was just before they adjourned—the Foster and Wheeler Corp. sent a letter to the Joint Committee reserving the right to increase their price.

This original price, which was about $3,837,000 was subsequently raised to about $14 million, as I remember.

Mr. DAVIS. I think the $14 million did include the research and development as well. But the increase was from about the amount shown here to the $14 million.

Representative HOLIFIELD. It was about $5,472,000 to $14 million?

Mr. DAVIS. The $14 million was not a fixed price. It was an open ended price estimate.

Representative HOLIFIELD. Apparently they were not ready, private industry was not ready, to proceed on that, in spite of their indication previous to their cancellation that they were.

All right, let's go to the Chugach, $15,809,000 to $17,384,000.

Mr. DAVIS. The difference here, I believe, in the research and development is mainly a shift in the category. No; it is a shift in the

design costs here. The construction increase is primarily in the cost of containment. As you will recall, in an earlier hearing we covered the fact that the Chugach proposal as originally made did not contemplate containment, and the sum of about $2 million, if I recall correctly, has been added to cover the probable necessity for containment at the site.

Representative HOLIFIELD. What is the progress of this particular project? Are they still in the design stage or have they started construction?

Mr. DAVIS. They are still in the research and development stage very definitely. As you recall, we had this divided into a phase 1 research and development program and phase 2 research and development with the detailed design and construction in the later part of phase 2. They have now essentially completed phase 1 and are now moving into the research and development associated with phase 2, including studies of both large-scale and small-scale plants, but not yet going into the detailed design of the plant itself.

Representative HOLIFIELD. Mr. Toll.

Mr. TOLL. When the Commission testified earlier this year on this Chugach project, it was indicated that a decision as to whether to proceed with construction has not yet been made. Is that correct? When do you anticipate that decision might be made, if it is still in preliminary research and development?

Mr. DAVIS. It is still in preliminary research and development, and it was contemplated that this would be made in about the next 18 months, as the best guess I can give it at the moment.

Mr. TOLL. Why is the authorization for construction funds necessary at this time? Isn't this project comparable to the Pennsylvania Power & Light project, in that you have not yet reached a decision as to construction, and it is not necessary to include funds for construction at this time?

Mr. DAVIS. Well, I think here again if we did not include a contract contemplating the construction, we would not have any assurance then about the cost of construction. They have given us a price on the cost of construction and this is included in the arrangement. If there were no contract at this time which contemplated the construction of the plant, then we would have no call on them for fixing the price of constructing the plant.

Mr. TOLL. Would it be possible to have the same type of contract arrangement in this case, and would it be more realistic to follow the same type of contract here, as has been followed in the Pennsylvania project?

Mr. MORRIS. That is essentially what we are doing, Mr. Toll. The contract we have and which we are about to extend covers research and development only. We have not yet contracted for the construction with NDA nor have we contracted with Chugach for the operation of the reactor.

Mr. RAMEY. But in one case you want authorization of funds for construction, in the case of Chugach, and in the case of Pennsylvania you don't, is that right?

Mr. DAVIS. In the case of Pennsylvania, we are not paying the cost of construction of the plant.

Mr. TOLL. But you do have a preconstruction phase 2. Your footnote says authorization will be requested at a subsequent year. Couldn't that same approach be followed in the Chugach case without any harm to the project?

Mr. DAVIS. We are now entering into the second phase of the Chugach arrangement, which is equivalent to entering into the second phase of the Pennsylvania Power & Light. What we are talking about on Pennsylvania Power & Light here today is phase 1. We have now passed through phase 1 of the Chugach, and we are talking about phase 2, and this is the phase which does lead to construction.

Representative HOLIFIELD. You are far enough advanced on the Chugach to go into your phase 2 contract?

Mr. DAVIS. Yes, which is still research and development, but if terminated successfully, which will lead to the construction of this plant.

Representative HOLIFIELD. Is it contemplated that that will be terminated within the 1959 fiscal year?

Mr. DAVIS. No. As I indicated it would probably be about 18 months before we would be in a position to make a positive decision to proceed with the construction.

Representative HOLIFIELD. Well, would you be likely, then, to be placing contracts for materials before the end of the 1959 year?

Mr. DAVIS. I don't believe so. Not for materials for the plant itself?

Representative HOLIFIELD. Construction materials.

Mr. Toll's questions, then, are very pertinent. They are to the same point then, that what you are in effect asking for is authorization for construction funds which you will not need before fiscal 1960.

Mr. DAVIS. We would not need the funds before fiscal 1960; that is correct.

Mr. TOLL. This authorization could be asked for next year just as well as this year, these construction funds for the Chugach project.

Mr. DAVIS. The funds themselves could; yes.

Representative HOLIFIELD. All right.

Mr. MORRIS. This item, Mr. Holifield, was included in the 1958 authorization bill. We are updating the figures. We did not feel we could drop it out, as we have done Wolverine.

Representative HOLIFIELD. We approved the $15,809,000, and you are updating it about $3.5 million. What you are really asking for here is the authorization for the additional $3.5 million, is that right?

Mr. MORRIS. We are asking for recognition of that on the basis of more current estimates.

Mr. DAVIS. These were authorized last year as a line item for the total. This is how we now get at the new total, which is almost $4 million higher.

Representative HOLIFIELD. This is really an increase, then, in a previous authorization.

Mr. DAVIS. That is how it is submitted, yes, sir.

Representative HOLIFIELD. Your next three projects are the Northern States, Carolina-Virginia, and East Central Florida West Coast group.

We authorized $30 million in a lump sum last year, as I remember, for third-round participants, and these three are now estimating the cost at $31,551,000 or an additional $1,551,000. You are asking here for the authorization to be raised that much?

Mr. DAVIS. That is correct, yes, sir.

Mr. TOLL. Is Pennsylvania Power & Light not considered part of the third round?

Mr. DAVIS. As you recall, Mr. Toll, we submitted it as part of the third round and then withdraw it after the hearing and are now resubmitting it for separate authorization.

Mr. TOLL. So are you with the Florida project. But is it third round or not?

Mr. MORRIS. It is not. To the extent that the East Central nuclear group and Pennsylvania Power & Light are both up here for authorization, the heading in the table is misleading, or, rather, the subtotal as we have shown it. East Central nuclear group, the Florida West Coast nuclear group project, and the Pennsylvania Power & Light project are both here for authorization, and neither one is presented here as a third-round project.

Mr. TOLL. The total for the projects that are of the third-round type is really being increased from $30 million to $38.5 million, rather than $31.5 million.

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. Then we are not considering, even though you have it listed here in this chart, the Pennsylvania Power & Light as a third-round project because it does not involve construction. We are considering it as a special case on research and development. Is that not right?

Mr. DAVIS. They are both cooperative arrangements and are being submitted as such.

Representative HOLIFIELD. What did you say?

Mr. DAVIS. I said they are both cooperative arrangements and are being submitted as such but outside the ground rules of the so-called third round.

Representative HOLIFIELD. But in the Florida case, there is a commitment on construction, is that not so?

Mr. DAVIS. There is a commitment, yes, sir.

Representative HOLIFIELD. And there is not on the Pennsylvania Power & Light.

Mr. DAVIS. In the Florida group, there is a commitment to construct. There are certain qualifications, as have been outlined in the data sheet, with respect to the cost of the plant and things of this sort, which, if they are not achieved, then there would not be a commitment to construct.

Representative HOLIFIELD. Sort of an escape clause, in other words, for private enterprise in case they don't want to take it on.

Mr. DAVIS. Yes, sir.

Mr. RAMEY. Have there been any changes in the Florida arrangement since it was proposed to the committee and hearings were held on it in February or March?

Mr. MORRIS. No, there have not been any.

Representative HOLIFIELD. Mr. Toll.

Mr. TOLL. Over on the third page, the item fast breeder, research and development, $1.5 million. Could you please itemize in detail for the committee how those funds have been expended?

Mr. DAVIS. I don't believe I could——

Representative HOLIFIELD. Can you tell us if this was all work at AEC laboratories?

Mr. DAVIS. I believe it has all been spent in AEC laboratories, primarily by Argonne. The total amount which has been spent as of April 30, I believe, amounted to $527,000, if my memory serves me correctly. It has been mainly concerned with conducting radiations at the MTR, providing essentially consulting services to the PRDC group, and in preparation for carrying out critical experiments and things of this sort.

Representative HOLIFIELD. This was the $1,500,000 that we furnished you last year that you are speaking of?

Mr. DAVIS. That is correct; yes, sir.

Representative HOLIFIELD. And it has been principally used, then, for problems concerning the PRDC project?

Mr. DAVIS. It has been spent for the kinds of things that were set forth under the contract, but as a part of our program, supplying assistance, technical data and information to PRDC.

Representative HOLIFIELD. Now you are asking for another $1,500,000 for the same purpose?

Mr. DAVIS. That is now $1,250,000 for fiscal year 1959.

Representative HOLIFIELD. That is not the same amount. I see.

Mr. TOLL. Included in the funds in section 109 of H. R. 12459 is a request of authorization of funds for the PRDC project in the amount of $4,309,000.

Mr. DAVIS. Yes. We are requesting the authorization of $4,309,000 and I believe we are requesting $1,250,000 in funds for this year.

Mr. TOLL. The amount in the contract is how much?

Mr. DAVIS. The amount in the contract is $4,450,000, of which $141,000 was spent before the authorization proceedings were required, if you recall, so that we have treated it as an amount for authorization of $4,309,000.

Mr. TOLL. In effect, the Commission is still requesting the total amount, authorization for the total amount, provided for in the contract without any reduction for work that has been done under this $1.5 million; is that correct?

Mr. BURROWS. The additional authorization is $1.5 million less than the $4.3 million. The additional authorization being asked for at this time is $2,809,000.

Representative HOLIFIELD. What is this for?

Mr. BURROWS. For the project we are speaking about.

Mr. TOLL. We will get to that a little bit later on, I guess, when we get to section 109. In this chart, the backup sheet on section 109, it says required authorization for fiscal year 1959, $4,309,000, and adding that to the $20 million, it asks for an increase in the amount of the act of 24 million-some dollars.

Mr. BURROWS. If you look at the other column you will see there is $1.5 million which has been given recognition, so the difference comes to a net of $2.8 million.

Mr. TOLL. You are right. Thank you. That is what I was trying to find out here. Recognition is being given to this $1.5 million that we are talking about now.

Representative HOLIFIELD. Does the AEC wish to give us any information on the Pennsylvania Power & Light, any additional information, before we call upon the representatives of the Pennsylvania Power & Light to give us a report on the $5.5 million they have already spent?

Mr. DAVIS. Well, I believe the project is pretty well described in the justification data that has been submitted.

Representative VAN ZANDT. If you would, Doctor, could you refresh our minds on it, the historical background of it?

Mr. DAVIS. Well, the project arose as a project between Pennsylvania Power & Light and the Westinghouse Corp. for the development of a slurry type homogeneous reactor. They made a decision to pursue the so-called single region slurry reactor, and last year made us a proposal after they had spent a very substantial sum of money on this, for us to——

Representative VAN ZANDT. What was that amount of money, do you recall?

Mr. DAVIS. I believe it was about $5.5 million as of the end of last year. They made a proposal to the Commission to support the research and development work, which Westinghouse is conducting on this particular type of reactor in contemplation that if the work were successful, they would build a full-scale homogeneous reactor of somewhere between 70,000 and 150,000 electrical kilowatts.

Representative VAN ZANDT. Was this the proposition that the Comptroller General ruled illegal under existing law?

Mr. DAVIS. He ruled that it was not acceptable under the ground rules that we had established for the third round of the power demonstration program.

Representative VAN ZANDT. So what we have before us this morning, then, is a new proposal of the Commission, as far as an agreement with the Pennsylvania Power & Light Co.?

Mr. DAVIS. This is a new proposal for separate authorization of this project; yes.

Mr. RAMEY. Mr. Davis, in the letter from Dr. Libby of May 9, 1958, the Commission provided a further explanation on patent matters. Could you at least summarize the arrangements as to the patents in this new proposed arrangement?

Mr. DAVIS. Do you want me to read this?

I think this summarizes the arrangement.

Mr. RAMEY. Fine.

Mr. DAVIS (reading):

> It has been agreed that the Atomic Energy Commission would have option in lieu of a refund by the companies of funds spent by the Commission for phase I work to retain instead ownership of all inventions made during phase 1, granting to the companies an irrevocable royalty-free license with a nonexclusive right to grant nonexclusive sublicenses on foreign patents on such inventions. This would make possible the protection of the Government's interest in cases where the patent rights which proposers would receive as a result of the rebate appear to be of greater value than the amount of the repayments. Item 2 was with regard to inventions arising out of the work supported wholly by the companies during the periods July 1955 to December 31, 1957. It was agreed that the Atomic Energy Commission would receive a nonexclusive irrevocable royalty-free license for government use on any atomic energy inventions arising during this period.

This is a change which has been made in resubmitting this proposal.

Mr. RAMEY. Have you provided the committee with a list of the inventions that have been made or on which applications have been made, for this period in which the company operated under its own funds?

Mr. MORRIS. No, we have not.

Mr. RAMEY. Didn't we ask for that?

Mr. MORRIS. I don't believe so.

Mr. RAMEY. Could we be provided with such a list? And also as to the characterization of their importance?

Mr. MORRIS. Mr. Anderson, AEC patent counsel, is here. As to the feasibility of doing this, I would like him to respond.

Mr. ANDERSON. When Westinghouse Corp. gives us that list, we will be pleased to provide it to the Joint Committee. They have not yet supplied us with a list of applications that fall within this first phase.

(The list referred to appears on pp. 343–345.)

Mr. RAMEY. Wouldn't that be of some importance in deciding how some of these power arrangements should be? If the inventions are of no particular importance, then possibly the Commission itself getting a license on them as proposed here would seem to be appropriate. If they are very important, basic patents, then the Commission getting a license would not help out the rest of the industry any on this sort of arrangement.

They are supposed to be for the benefit of the public at large.

Mr. ANDERSON. I think the present arrangement provide for that, in that the Government gets a license for governmental purposes in any event. If at the time phase 1 is completed and Westinghouse desires to refund AEC's money, AEC has the privilege of refusing and keeping the patents for all purposes, with the license in Westinghouse.

Mr. RAMEY. Does that apply to the patents occurring during this initial period?

Mr. ANDERSON. Phase 1.

Mr. RAMEY. How about the prephase 1? That is, during the period 1955 to now?

Mr. ANDERSON. As to prephase 1, or what might be said to be background, the Government acquires a license, and Westinghouse has indicated to the Commission that they are willing to grant licenses to third parties on reasonable royalties. Of course, if the reasonable royalties could not be agreed upon by the two parties, I suppose section 153 of the Atomic Energy Act could be invoked to have the royalties fixed in accordance with the procedures set forth in section 153.

Representative HOLIFIELD. In order to draw a line between the expenditure of $5.5 million by Pennsylvania Power & Light and the $7 million of the Atomic Energy Commission, is it not advisable that you have a list of the patent applications which have already been made under the $5.5 million expenditure so you will know what you are starting from a base line before the $7 million?

Mr. ANDERSON. Yes, sir. I understand that Westinghouse was to furnish this kind of information promptly, and we are awaiting that. As soon as that information is received, we will be able to determine what was in the $5.5 million, and then what comes under the phase 1.

Mr. RAMEY. On that assurance about cross licensing and a reasonable royalty, is this a unilateral assurance or is this contractual?

In other words, are they legally obligated to do this?

Mr. ANDERSON. At the present time, there isn't any contract, I don't think. This is a provision that probably could be worked out and incorporated in definitive terms of the contract, whereby they

would be under the obligation. I will say that Westinghouse has indicated this as their company policy and, so far as I know, have lived up to that policy.

Mr. RAMEY. I have one other question on the Commission's right to patents in the event that the other party, Pennsylvania, decides not to go ahead with the project. Isn't this sort of an all-or-nothing arrangement? In other words, the Commission, if it pursued the project, and pays the money, will get all of the titles and, if it doesn't, it will only get a license?

Mr. ANDERSON. For governmental purposes, that is correct.

Mr. RAMEY. Yes. In other words, if it wants to protect the public interest and make those patents available to other manufacturers, it has to kick in the whole amount of the cost of the research and development program rather than possibly just the value of those patents?

Mr. ANDERSON. That is correct. I presume that in determining the question of whether or not one would take complete title and rights, evaluation would be made and one would know pretty much at that time, 2 or 3 years probably hence, as to the value of these disclosures.

I think we have to bear in mind that oftentimes a lot of patent applications are filed, but the patents that issue are much more restrictive than the initial application disclosures as filed with the United States Patent Office.

Representative HOLIFIELD. Does that not also bring about the fact that many times patent applications are more valuable than a patent granted?

Mr. ANDERSON. No, sir; for the reason that until you get a patent, you cannot enforce the right. It is only a patent that can be enforced in the courts or in administartive tribunals and elsewhere.

Representative HOLIFIELD. But the balance of the patent rights have not been determined where a patent application exists, and, therefore, the area of encroachment is not so easily determined.

Mr. ANDERSON. I think this is true, that it is difficult to determine the realm or the possibilities or the scope of a patent application. But in determining any value in a patent application, the primary factor is what has the patent office allowed. That is the only thing that anyone can enforce. The patent applicant can claim many things. But when it comes down to the final analysis, it is the claims of the patent which determine the scope of a man's right and obligation so far as enforcement is concerned.

Representative HOLIFIELD. I believe now we will have the Pennsylvania people come to the stand, Dr. Davis, and the Westinghouse people representatives.

STATEMENTS OF JACK K. BUSBY, PRESIDENT, PENNSYLVANIA POWER & LIGHT CO.; CHARLES WEAVER, VICE PRESIDENT, WESTINGHOUSE ELECTRIC CORP.; AND DR. W. E. JOHNSON, PROJECT MANAGER, WESTINGHOUSE ELECTRIC CORP.

Representative HOLIFIELD. Gentlemen, the interest of the committee this morning, to begin with, is on the subject of the accomplishments which you have made under the $5.5 million expenditure which you have made of your own private funds.

The committee wishes to know what kind of a partnership we are buying into. Are we buying into a partnership that has accomplished something with the figure of $5.5 million, or has it just outlined the areas of research.

Mr. BUSBY. Mr. Chairman, that is a very reasonable question. We have tried, as you know, in section 202 hearings last year and this year, to submit to the committee progress reports on the status of what we had done and what we proposed to do.

It is correct, as has been stated by the AEC, that through the end of 1957 approximately $5.5 million has been expended by Westinghouse and P. P. & L.

Dr. Johnson, manager of the project is here, and fully prepared to give you a review or detail of what has been done in the period 1955 through 1957 in connection with the spending of that money.

Representative HOLIFIELD. The committee has reecived your reports.

Dr. Johnson, would you like to summarize for the benefit of the committee, what you consider the main accomplishments under the project which you have pursued at a cost of $5.5 million?

Mr. JOHNSON. As we have reported previously, we started this project in mid-1955, with a small technical group of about 10 people. We very quickly increased the size of this group to where, by the middle of 1957 and continuing since that time, we have a professional group, that is, engineers and scientists, of between 70 and 75 people. In addition to this, we have on the order of 30 to 35 technicians. These are nonprofessional people, people who work in the laboratory. All of these people, the engineers, scientists, and technicians, work full time on this project. This does not include support services that supply all of our atomic power department facilities such as analytical laboratories, metalgraphic laboratories, and drafting. We have spent approximately $2 million in special laboratory facilities. These are laboratory facilities that are devoted full time to the PAR project. Special experimental test loops are examples, or the development of test loops to go into a reactor. Again, these funds do not include any of the service laboratories, that belong to Westinghouse. These are outside of the $2 million in laboratory equipment.

Representative HOLIFIELD. Does the $2 million include brick and mortar construction of buildings?

Mr. JOHNSON. No; it does not.

All of that is what we would call facilities which are paid for by Westinghouse out of Westinghouse capital funds.

Representative VAN ZANDT. Is it in addition to the $5 million spent by Pennsylvania?

Mr. JOHNSON. Yes; it is in addition. We have rather extensive laboratories, that belong to the facility. They are not included in the $5.5 million. All of the $5.5 million is money spent directly by the project for the project. It does not include any capital facilities as such. It does include, however, any special test facilities. I believe in the last hearing we showed you a photograph of a large 4,000-gallon-per-minute test loop, which is the largest of its type in the country. This cost us about $600,000, and is included in the $2 million in materials.

Representative VAN ZANDT. You say that is included?

Mr. JOHNSON. That is included. We consider it as a special test facility, designed for this project.

Representative VAN ZANDT. What is the status of the large test loop at the moment?

Mr. JOHNSON. That large test loop has gone through all of its preliminary phase testing. We have handled this as we would normally handle the circulating loop of the reactor proper. As you may remember, this is half the size of one loop of the proposed plant. At the present time, the loop is having additions made to it which are designed to test the operating characteristics of the reactor. In particular, we are making an addition of about $100,000 in value to test the draining characteristics.

Initially the loop was designed as a basic loop which would correspond to the reactor in normal operation. We are now steadily adding to this the other systems which would go to make up the reactor proper. We will do this on a step-by-step basis. At the present time, we are adding, as I say, this large drain and fuel-handling system, which will be in operation about the middle of July.

As the program proceeds, when we have finished the drain system testing, we then plan to add to this basic loop a large pressure vessel, about 4 feet in diameter. We also plan to add a prototype heat exchanger, which would be about a quarter of the size of one of the heat exchangers for the actual plant.

Eventually we should have in this large, basic test loop, a nonnuclear prototype of the reactor plant itself.

Representative VAN ZANDT. Doctor, are you installing these items in a new addition to your building at East Pittsburgh?

Mr. JOHNSON. There was a new addition to the facilities put into operation just about a year ago, I believe in April of 1957. This was an addition which cost about a quarter of a million dollars, and, again, this is Westinghouse capital funds.

Representative VAN ZANDT. Is this included in the $2 million?

Mr. JOHNSON. It is not included in the $2 million. It is, again, bricks and mortar, and goes into the Westinghouse capital account, which is separate from the project account.

Representative VAN ZANDT. Then Westinghouse to date has spent about $2.25 million; is that right?

Mr. JOHNSON. I would say in capital facilities, which are pertinent to this project directly, we have spent in excess of $1 million. This is in analytical laboratories, test floor space such as building, and this type of thing. This does not, of course, include the basic facility itself in which we are housed. I am not sure what the value of this is, but I am sure it is several million dollars.

Representative VAN ZANDT. What has been done to develop the control and maintenance of this type of reactor?

Mr. JOHNSON. I would say of the total of $5.5 million, roughly $1 million to $1.5 million has been spent in the general area of remote maintenance. This consists of designs of equipment which can be maintained remotely. It includes the installation of test facilities to verify these techniques. We have a relatively large area, I would say probably one of the largest, including those in Commission facilities, for experimentally verifying the techniques of remote maintenance as they apply to a full-scale plant. We have carried to essential feasibility completion the process of remote welding, which will be necessary for this type of plant. We have carried out rather extensive studies on the maintenance of particular pieces of equipment.

As an example, the main circulating pump is a piece of equipment on which you would normally expect to have routine maintenance. We have built a full-scale carbon steel prototype of such a pump, and are at the moment going through the nut-and-bolt procedures of disassembly and reassembly in order to get a real feel for the work, the special facilities, the costs of these facilities, and for the time that is required.

All of this information is pertinent to coming up with the capital cost and the operating cost of this type of a plant.

With respect to the slurry fuel itself, I believe that when we entered this project we felt that the handling of this type of fuel was one of the major problems that was facing the project.

I would say that today we feel relatively sure that we can handle this type of fuel in a practical manner in a large plant.

Representative VAN ZANDT. Does that mean, Doctor, you have actually solved the problem of material?

Mr. JOHNSON. I was going to say the second part of the fuel is the erosion of materials by the fuel.

Again we felt that this was a very major question when we entered this program. I would say that today we feel rather relaxed with respect to the erosion problem, except in very particular areas. In very high velocity areas, such as the impeller of a main circulating pump, we still have problems. We have a special material development program to carry out there. In the trim on valves, where, again, you have high velocity, we have particular problems. I would say that on the overall problems of materials, we have made very appreciable progress during this period and are continuing to make progress in this area.

With respect to the system design, the process design of the plant, here again, I think we have taken rather naive ideas at the beginning of the project and have converted them into practical designs which I believe will not be appreciably modified from what we have today to what would actually be built in the final plant. As you know, in this type of reactor, in fact, one of the advantages of this type of reactor is that you have reasonable flexibility in how you operate the reactor. As a consequence, we have many alternative subsystems that could go into the basic reactor system. This is the type of work that we are doing today in considerable detail, and slowly but surely narrowing and finalizing the process design of the plant.

I believe, as I say, we have made appreciable advances in this particular area.

In the development of components as such, not as systems but pieces of systems, I believe we have carried out feasibility studies of every major piece in the reactor plant. In almost every area we say that there are feasible designs. In some areas we still need more information, and our program is specifically designed during this 1958–59 period to concentrate on these areas where we do need additional information.

I can list a few of these. The flow distribution inside of a large reactor vessel. We have to be sure that we have uniform suspension of the fuel. We have a very major program under way, and the 4-foot reactor vessel that will go into the large test loop is part of that program. The effects of radiation on slurry and on the erosion-corrosion effect is another area where we do not today have enough information

to say whether it is feasible to proceed or not. This is a large development program, one that we are carrying out jointly with Oak Ridge National Laboratory. The actual in-pile loop itself is essentially ready for test in Pittsburgh and is scheduled to be shipped in August or September of this year.

We certainly feel that we need more hardware-type experience on the maintenance of particular components, and we are having fabricated other prototype pieces of equipment that we can take out into the laboratory, assemble, disassemble, and repair, to get the same type of information as I outlined with respect to the large circulating pump.

All in all, I would say that we have made very appreciable progress in the 2½ years, certainly enough that the technical supervision of the project was willing to recommend to our higher management that it was feasible to proceed on this next 2-year program.

Representative VAN ZANDT. Doctor, could you give us an estimated overall cost as far as Westinghouse is concerned? This applies to the research and development work, the expansion of your facilities, and so forth?

To me, $2 million would not represent the actual cost from what you have said here:

Mr. WEAVER. I believe, Mr. Van Zandt, the best estimate I could give would be $2 million of capital expenditures, and the provision of such service facilities as Dr. Johnson has mentioned, over and above the $5.5 million.

In other words, that the two companies together have probably put as much as $7.5 million into the project.

Representative VAN ZANDT. $7.5 million?

Mr. WEAVER. Yes.

Representative HOLIFIELD. Of course, that $2 million of capital investment is a remaining asset and is for other purposes.

Mr. WEAVER. This is correct, Mr. Holifield. I would like to emphasize, though, that the new building that was constructed to house this large test loop that Dr. Johnson referred to was erected specifically to accommodate this project. It would not have been done otherwise.

Representative HOLIFIELD. You have been working about two and a half years on this project and you anticipate about a 2-year further program of R&D?

Mr. JOHNSON. As I pointed out earlier, there were specific areas where we did not feel that we had enough information to make a decision to proceed. We felt it would take about 2 years in order to develop this information.

The total program for the next 2 years, however, incorporates more than these specific areas. I would say that perhaps half of the dollar expenditure, or somewhat less than half of the dollar expenditure, is directed specifically to these areas where we need more information before we could even determine feasibility.

The other half of the $7 million is moving the whole project ahead. So where the decision to proceed has been delayed 2 years, I would say the end date certainly has not been delayed more than 1 year. That is, about half of what we are doing now, is work that we normally would have done if the project had been authorized as of the 1st of this year.

Representative HOLIFIELD. As I recall, this particular type of reactor was a reactor that Dr. Libby thought the Government should proceed on some time ago. Is that right, Dr. Libby?

Dr. LIBBY. I still feel that way, Mr. Holifield. It has the merit of attacking the whole problem at once.

The heterogeneous power reactors sort of sweep part of the problem under the rug in the sense that the chemical reprocessing is left until a little bit later. This reactor attacks the whole problem. I suppose it may be because I am a chemist, and this is sort of a chemist's reactor, but it is my favorite, starting from scratch.

I must say, however, that the water reactors have gotten pretty far out ahead in the race. This one is still—well, it has just barely left the post, I would say. It has to get running pretty soon or the race will be over. But I would still bet a lot on the homogeneous type of reactor, because I think it is based on good, sound principles.

The remote maintenance problem is a tough one, and the corrosion problem, in the form which is not particularly applicable to Pennsylvania Power & Light and Westinghouse version, is a tough one. But I have liked the general principle of the homogeneous reactor very much and still do, although the water reactors and organic reactors are getting well along and the race may be over before the homogeneous gets to really running. I hope not.

Representative VAN ZANDT. What is the status of our homogeneous reactor?

Dr. LIBBY. Perhaps Mr. Davis should answer that. He has more detail.

Mr. DAVIS. I talked to the Oak Ridge people either last Thursday or Friday, I can't recall the exact day, and at that time they had the H. R. E–2 back in operation again, operating it sort of as a modified single reactor. They still have the leak between the inner and outer regions by the crack in the core liner, but were successfully operating the reactor with a small amount of leakage, with a more concentrated solution, and were ending up with about one-half of the concentration in the blanket. So they are proceeding and do think that if this operation continues to be successful, they can accomplish quite a bit of what they hope to accomplish with H. R. E–2, even though they do have this rather serious crack in the inner core liner.

Representative VAN ZANDT. How long was it down, Doctor?

Mr. DAVIS. It was down I would guess 5 or 6 weeks, between the time they got the indication of the crack and the time they went back into operation at the end of last week.

Dr. Johnson might know a little more than I do about it, or more recently. I don't know.

Mr. JOHNSON. I would say the 5 weeks was a good figure for the down time on the reactor, most of which was spent trying to determine where the leak was, and using equipment to try and physically see the leak. They were not successful in doing it.

Representative HOLIFIELD. The Oak Ridge model operates on a solution, which has true suspension in relation to the slurry, doesn't it?

Mr. JOHNSON. Basically the design there is to have a solution in the core with a slurry in the blanket region. This is the two-region concept being developed.

Representative HOLIFIELD. They are only working on the one region.

Mr. JOHNSON. The initial operation of the reactor was to be only with the core region having active material and heavy water in the blanket. But the basic concept includes solution core and slurry blanket.

Representative HOLIFIELD. Are you speaking of theirs or yours?

Mr. JOHNSON. Of theirs.

Representative HOLIFIELD. Yours is slurry all the way through?

Mr. JOHNSON. Ours has only 1 region, not these 2 regions, and it is a true suspension, a slurry, with a concentration of about a third of the solids as proposed for the Oak Ridge type.

Representative HOLIFIELD. Is your theory susceptible to more erosion and corrosion than the solution principle?

Mr. JOHNSON. There are two words you use there, "erosion" and "corrosion." Erosion is the mechanical attack of a surface by particles. Our reactor is subject to erosion as is the blanket region of the Oak Ridge reactor. Corrosion is the chemical attack of solutions on materials. It is the core region of the two regions, which is susceptible to corrosion.

This probably is what happened with respect to their liner. One of two things probably happened: Either it cracked or it was corroded by the acid fuel solution.

Representative HOLIFIELD. We keep hearing reports, and they are merely in the form of rumors, that there have been some breakthroughs in this slurry field. Have any of the patents which you have applied for been in the slurry field?

Mr. JOHNSON. None of the patents, I believe, have been in the slurry field. I heard the same type of statement made here at the last hearing we had, and I have tried to find out what you are referring to. I must say I do not know what this breakthrough is.

Representative HOLIFIELD. I don't know either. Is it your intention to give a list of your patent applications with proper distributive data on each one to the Atomic Energy Commission before you enter into a contract?

Mr. WEAVER. This is certainly something which we would contemplate doing, and we realize the necessity of firmly fixing what has been done prior to the date that this contract will be effective.

We have such a tentative list, and we will be together with the Commission on the matter at their disposal.

(The list referred to follows:)

WESTINGHOUSE ELECTRIC CORP.,
East Pittsburgh, Pa., June 23, 1958.

Subject: PAR inventions prior to January 1, 1958, G. F. 8526.

Mr. ROLAND A. ANDERSON,
United States Atomic Energy Commission,
Patent Branch, Office of General Counsel,
Washington, D. C.

DEAR MR. ANDERSON: Enclosed herewith is a complete list of all of those disclosures received by the Westinghouse patent department on pre-1958 inventions relating to the Pennsylvania advanced reactor project with an indication of the current status of each.

Further information in regard to serial number, filing date and a short résumé of those disclosures which have not been deferred will be forwarded in the near future.

Very truly yours,

D. J. SMITH,
East Pittsburgh Patent Division.

PAR inventions, prior to Jan. 1, 1958

Disclosure No.	Inventor	Title	Status			
			Deferred	Filed	To be filed	No decision
29,819	W. A. Frederick	Method of returning concentrated slurry.	X			
31,230	Q. D. Novinger, et al.	Steam generator		X		
31,231	J. R. Huston, et al.	Pump		X		
31,232	W. A. Webb, et al.	Reactor		X		
31,233	do	do		X		
31,234	do	do		X		
31,235	W. P. Haass, et al.	do	X			
31,236	H. F. Hatfield	Layout of reactor plant	X			
31,267	R. Fruehauf	Semicanned pump	X			
31,268	L. W. Tong	Magnetic oscillating mixer	X			
31,473	W. A. Frederick	Zenon poison generation		X		
31,694	G. Kivenson, et al.	A probe for the remote determination of liquid level.				X
31,933	J. D. Lokay	Canned motor pump	X			
31,935	G. Kivenson	Magnetic shaft damping			X	
32,241	J. D. Lokay	Handling fixture attachment	X			
32,430	H. F. Hatfield	Lockwasher and tools	X			
32,465	R. G. McGrath	Detecting leaks of radioactive material.			X	
32,466	do	A method of venting gas from canned motor pumps.				
32,467	G. R. Taylor, et al.	Rheometer for plastic non-Newtonian suspensions.				X
32,517	W. A. Webb	Slurry letdown concentrator and evaporator.	X			
32,842	R. T. Meurer, et al.	A positive seal for penetrations	X			
32,843	J. A. Vreeland	Heterogeneous liquid metal fuel reactor.	X			
32,844	do	do	X			
32,845	do	do	X			
32,846	do	do	X			
S. Ph. 12,324	do	An electric cigarette lighter for home use.				X
S. Ph. 12,327	do	A heater for heating single cups of water.				X
33,089	do	Surge volume for reactors	X			
33,109	R. Fruehauf	Special stud and tool wrench	X			
33,110	R. C. Chancy	Bolt holder No. 2	X			
33,111	do	Bolt placement and removal	X			
33,112	do	Flange clamp actuator	X			
33,179	A. C. Etzel, Jr.	Container support	X			
33,239	R. C. Chancy	Plate lifter	X			
33,343	D. Rinald	Fission product storage and disposal		X		
33,344	J. Weisman et al.	Absorption beds		X		
33,390	R. C. Chancy	Bearing puller	X			
33,391	do	Plate tongs	X			
33,468	W. P. Haass	Nuclear reactor plant vapor container.				X
33,858	R. C. Chancy	Bolt latch	X			
33,904	W. A. Webb	Thermal shield system for slurry reactor vessel.	X			
33,930	do	Guide vanes in reactor				X
33,965	R. G. McGrath	Instrument for measuring the total activity of a flowing radioactive fluid.			X	
33,966	G. Kivenson et al.	Apparatus for measuring slurry dispersion.	X			
33,967	W. E. Foster et al.	Determining high temperature settling rates of slurries.	X			
33,968	L. S. Tong	A floating internal-cooling thermal shield.				X
33,980	S. Bartnoff	Gas sample collector	X			
34,002	H. L. Collins	Reducing the amount of steam required for reactor pressurization.	X			
34,068	W. A. Webb	Reactor plant steam generator	X			
34,169	H. L. Collins	A high head slurry pump	X			
34,228	W. A. Frederick	Slurry in the primary system of a slurry reactor.				X
34,255	R. Fruehauf	Steam generator mounting	X			
34,311	G. Kivenson	Sampling valve	X			
34,340	C. R. Bergen	Continuously scavenging oxygen	X			
34,391	W. A. Frederick	Adjustable letdown device	X			
34,425	R. C. Chancy	Pump impeller lock	X			
34,458	D. G. Gardner	Reactor fuel				X
34,464	L. S. Tong	Recirculating vane				X
34,465	F. Ottenheimer	Flushing insert	X			
34,556	J. A. Vreeland	High head slurry pump	X			

PAR inventions, prior to Jan. 1, 1958—Continued

Disclosure No.	Inventor	Title	Status			
			Deferred	Filed	To be filed	No decision
34,557	H. L. Collins	Thermal shield concept for the PAR spherical reactor.				X
34,558	L. F. Picone	Dispersion and homogenization of slurry.	X			
34,589	G. Kivenson	Slurry mixing system	X			
34,590	do	Process viscometer	X			
34,591	do	Liquid sensing element	X			
34,616	W. E. Foster et al	Pressure relief means	X			
34,649	R. C. Chancy et al	Lifting and carrying tool	X			
34,743	D. F. Rinald	Control method for pressure letdown of a radiolytic gas flow.				X
35,126	J. R. Huston et al	Mechanical seal for PAR drain tank	X			
35,545	J. D. Lokay	Remote leak detection method for steam generators.				X
35,546	D. Rinald	Gas recombiner system			X	
35,914	A. C. Etzel, Jr., et al	Post mounted manipulator	X			
36,240	R. Fruehauf	Pipe positioner			X	
36,424	R. G. McGrath et al	Homogeneous reactor fuel handling system.			X	
36,426	R. G. McGrath	Homogeneous reactor startup			X	

Representatve VAN ZANDT. Mr. Weaver, as to the $7 million represented by AEC-sponsored work, will the AEC get title to all of the patents under this work?

Mr. WEAVER. Yes. I believe Mr. Anderson identified that under that agreement, the Commission would get title to all of the patents.

Representative VAN ZANDT. As to the $5.5 million of work already done by Westinghouse and the Pennsylvania Power & Light, will the AEC receive a license to use patents obtained during this period?

Mr. WEAVER. That is right; they will.

Representative VAN ZANDT. The answer is Yes?

Mr. WEAVER. Yes.

Representative VAN ZANDT. What degree of cooperation do you have, or we will say what degree of exchange of information do you enjoy with the Oak Ridge Laboratory?

Mr. JOHNSON. From the beginning of the project, we have had complete interchange of reports with Oak Ridge National Laboratory. We send them all of our formal reports, and any of our informal reports that they request. We get about the same return from them. It is a little more difficult for them to give us reports than for us to give them reports. We have, I would say, of the order of 2 to 3 groups from Pittsburgh go to Oak Ridge every month, and I would say of the same order of Oak Ridge people coming to Pittsburgh every month. I would say we probably have as close liaison between our two projects as any two projects in the country.

Representative HOLIFIELD. The committee understands that the end of the research and development period of time, whatever time that may be, that at that time there will then be discussions as to proceeding with what we have called the phase 2 part of the program.

In our previous hearing I think it was the general agreement at that time that phase 1 would not constitute any binding or legal obligation upon the AEC or upon the committee as to the phase 2 program, that we would all have a chance to sit down and look at the proposal at that time.

Mr. BUSBY. That is correct, Mr. Chairman.

Representative HOLIFIELD. And each one would exercise their particular rights within that sphere.

Mr. BUSBY. That is correct.

Representative HOLIFIELD. So your opinions here of phase 2 are for the information of the committee as to the general outline which you hope to proceed upon, and is not to be considered as a binding commitment in any way?

Mr. BUSBY. Indeed, it can be considered as representing some advance commitments by us, but none on the part of this committee in terms of what would be authorized for phase 2.

Representative HOLIFIELD. In other words, we will look at the program at that time and judge it on its merits?

Mr. BUSBY. Yes, sir.

Representative HOLIFIELD. Are there any further questions? If not, thank you, gentlemen.

Mr. BUSBY. Thank you, Mr. Chairman.

Representative HOLIFIELD. We will ask the Commission now to testify with regard to section 109 of the bill, which is the cooperative power reactor demonstration program.

STATEMENTS OF COMMISSIONER HAROLD S. VANCE, COMMISSIONER W. F. LIBBY, AND COMMISSIONER JOHN S. GRAHAM, ATOMIC ENERGY COMMISSION; ACCOMPANIED BY W. K. DAVIS, DIRECTOR OF DIVISION OF REACTOR DEVELOPMENT; DELMAR MORRIS, ASSISTANT DIRECTOR OF DIVISION OF REACTOR DEVELOPMENT; DON BURROWS, CONTROLLER; FRANK McCARTHY, ASSISTANT CONTROLLER FOR BUDGETS; A. TAMMARO, ASSISTANT GENERAL MANAGER FOR RESEARCH AND INDUSTRIAL DEVELOPMENT; L. OLSON, GENERAL COUNSEL; AND ROLAND A. ANDERSON, CHIEF, PATENT BRANCH, OFFICE OF GENERAL COUNSEL—Resumed

Representative HOLIFIELD. As I understand, this can be roughly broken into two sums. It is approximately $2,800,000 in one sum, which is for additional preconstruction research and development on the power reactor development phase, and $20 million for a lump-sum estimate, for an extension of the power-demonstration program. Is that a correct statement of this sum?

Mr. DAVIS. Yes, sir; it is.

Representative HOLIFIELD. The item in your unclassified treatment of $4,309,000 includes $1,500,000 which we authorized last year, and this is a request for $2,809,000 more in that particular field?

Mr. DAVIS. That is correct.

Representative HOLIFIELD. And that would represent research and development which would be conducted mainly in the Commission laboratory?

Mr. DAVIS. That is correct.

Representative HOLIFIELD. Or entirely? Should I say entirely?

Mr. DAVIS. That is, I believe, intended to be entirely in the Commission's laboratories.

Representative HOLIFIELD. Or under contract?

Mr. DAVIS. Or under contract.

Representative HOLIFIELD. And the results of that research and development would be available to all of industry?

Mr. DAVIS. The results of that work are available to all of industry and, in addition to that, under the terms of the contract that we have with PRDC, any of the information that they may develop as a result of spending their own funds or building the plant or operating it also become the property of the Commission and will be disseminated by the Commission through its normal channels, which means to everyone who is interested enough to get the reports.

Representative HOLIFIELD. Of course, if any patent position is developed in this field, in the $2,800,000 expenditure, that would be considered as Commission property?

Mr. DAVIS. That is correct; yes, sir.

Representative HOLIFIELD. Now in regard to the $20 million, is this sum completely in the field of waivers of use charges?

Mr. DAVIS. No, this would be for research and development work carried on as a part of the program and for waivers of use charges.

Representative HOLIFIELD. This would be the whole wide field of research and development?

Mr. DAVIS. This would be research and development under cooperative programs as well as the waivers of the fuel charges; yes, sir.

Representative HOLIFIELD. This would be in addition to the specific sums which we have talked about heretofore for the different projects?

Mr. DAVIS. Yes, sir. This would be like the $30 million which we discussed earlier and which was authorized previously.

Representative HOLIFIELD. Do you have any proposals or tentative commitments in this area of $20 million?

Mr. DAVIS. We have none at the present time.

Representative HOLIFIELD. I bring up this matter without any relation to the previous discussion. I received this morning from the Michigan Chemical Corp. a telegram, and a letter.

We will put both of them into the record at this point.

(The documents referred to follow:)

JUNE 9, 1958.

HON. CHET HOLIFIELD,
Chairman of Committee on Legislation,
Joint Committee on Atomic Energy, Washington, D. C.:

Michigan Chemical Corp. is planning to present a proposal to the Atomic Energy Commission for a process heat nuclear reactor requesting participation in the third round of the power reactor demonstration program contingent on suitable financing and proper approvals. This reactor proposed a major breakthrough in the present peaceful frontier of reactor development. It will be the first nuclear reactor to be constructed in the United States which will be competitive with conventional fueled plants, a letter outlining briefly the potential use of an economical nuclear reactor at our operations in St. Louis, Mich., will be brought to your office Tuesday morning June 10, 1958, by our Washington Representative Josiah Ferris.

Respectfully yours,

THEODORE MARVIN,
President, Michigan Chemical Corp. of St. Louis, Mich.

MICHIGAN CHEMICAL CORP., ST. LOUIS, MICH.,
Washington, D. C., June 9, 1958.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Legislation, Joint Committee on Atomic Energy, The Capitol, Washington, D. C.

DEAR MR. CHAIRMAN: At the suggestion of the committee staff, the following information is submitted for consideration by your subcommittee.

At St. Louis our present steam-producing facilities utilize oil as a source of fuel. The present requirements are 820 million pounds of steam a year at 175 pounds pressure (150 pounds would also suffice). Our overall steam costs are about $0.92 per 1,000 pounds of steam.

These facilities could be replaced with a coal-fired unit costing $1,500,000 and would produce steam at a calculated cost of $0.82 per 1,000 pounds of steam.

After considerable investigation we have come to the conclusion that a nuclear reactor costing $2,500,000 can produce our steam requirements at a steam cost of $0.81 per 1,000 with the possibility of this figure being reduced to below $0.70 in the future.

To our knowledge this is the first possible economical application of nuclear energy in the United States where it would be competitive with conventional fuels.

The most promising proposal submitted to us to date has been by the Martin Co. (of Baltimore, Md.) and the Ferguson Co. (of Cleveland, Ohio) as a combination. In their proposal they have specified the following guaranties, data, and estimated costs:

Nuclear reactor (firm bid)	$2,500,000
Fuel core (firm bid)	$336,000
Core life	[1] 45
Steam generation (guaranteed)	[2] 150,000
Steam pressure (guaranteed)	[3] 150
Fuel costs (guaranteed not to exceed)	[4] 37.2
Estimated other operation costs	[4] 40.2
Total estimated operating costs including depreciation	[4] 77.4

[1] Megawatt-years.
[2] Pounds per hour.
[3] Pounds minimum.
[4] Cents per 1,000 pounds of steam.

To the above estimated operating costs of 77.4 cents per 1,000 pounds of steam, Michigan Chemical would have to add 3.3 cents for standby charges for present equipment. Hence, the cost for each 1,000 pounds of steam in the reactor proposed should be 80.7 cents (say $.81).

Another proposal by Vitro Engineering Division of the Vitro Corporation of America and American-Standard Atomic Energy Division is along the same line as above but capital costs were higher although fuel costs were lower.

The following is a condensed analysis of costs (including amortization charges) that exist at Michigan Chemical along with comparison figures:

	Present Michigan chemical facilities	Proposed coal-fired facilities	Proposed nuclear power
Cost of plant	----------	$1,500,000	$2,500,000
	Cents	*Cents*	*Cents*
Basic fuel costs for 1,000 pounds of steam	67	46	37
Total costs for 1,000 pounds of steam	92	82	81

In the above, the basic fuel costs for the nuclear power should decrease with experience and it has been estimated that it will drop to a 27-cent range within a 5-year period due to improvement in core design and materials of construction as well as extended useful operating life.

Up to the present all proposed nuclear reactors have been intended for electric power generation, where high steam temperatures and pressures are required for efficient operation. It is doubtful if the immediate future will resolve the problems involved to a point where economical electric power will be produced with nuclear fuel.

However, our requirements here at Michigan Chemical are for process steam at relatively low pressures. This simplifies the nuclear reactor and enough is known at present to design a relatively economical unit.

Two important items which should interest AEC in helping us build the reactor are:

1. The nuclear reactor contemplated would be competitive with conventional fuels.

2. When the unit is proved successful a large potential use of nuclear power would result since there is a greater requirement for low pressure steam for heating and industrial processing than for electric power generation.

It is our desire and intention to approach AEC with a proposal to build and operate the reactor in question and thereby prove its economic advantages. This would be a major breakthrough in the present frontier of reactor development.

Our present financial position, although sound, does not place us in a position to finance the capital requirement for the reactor under the so-called third round of the AEC power reactor demonstration program.

We are at present trying to resolve this problem. If it cannot be resolved, we contemplate discussing with AEC the possibility of their advancing the capital required, with provisions made for its return.

We have not, as yet, arrived at a final proposal to present to AEC in the event we request part or all of the $2,500,000 capital requirement from them. Our thinking, however, revolves around the following facts and possibilities:

1. The 81-cent nuclear steam costs include a yearly amortization return of $125,000 which could be applied to the reactor cost.

2. Michigan Chemical would be willing to purchase the steam for their present costs, thereby making available another estimated $98,000 yearly for writeoff as a credit to the reactor cost.

3. In subsequent years, as the cost of steam is reduced, the savings could be applied to the cost of the reactor. Assuming a 10-cent per 1,000 pounds saving at the ends of the fifth year, an added $80,000 would be available for credit to the original reactor cost.

With the possible credits from the above, the capital would be returned in 8 to 20 years, depending on the circumstances.

Another possibility would be to apply the credits until the capital requirements are reduced to a point where Michigan Chemical could pay them and, at that time, an agreed-to lump sum would be due to AEC.

Other possible arrangements for the return of the capital are being considered as proposals.

We are convinced that here at Michigan Chemical we have a situation where an economic application of nuclear power exists. We further believe that the reactor proposes a major breakthrough in the present frontier of reactor development.

Respectfully submitted.

JOSIAH FERRIS,
Washington Representative.

Representative HOLIFIELD. As I say, I bring this in, without any relation to our previous correspondence, as an item of interest which occurred.

Mr. DAVIS. I believe I mentioned the other day, Mr. Holifield, that we were expecting that we would get a proposal for a process heat reactor. This is the group with whom we have had some informal conversations.

We are aware of their plans. We, possibly, have received a letter from them, also, today, but I have no way of knowing at the moment.

Mr. RAMEY. Isn't it quite possible that, with respect to process heat reactors, the type of support that the Commission offers under the power demonstration program might not quite fit the situation of process heat reactors? Your power demonstration program is geared to the electric utility industry, whereas here you are dealing primarily with chemical outfits and paper outfits and others who usually, or, in some cases, as in this case, aren't so large, and their methods of financ-

ing are different, and their methods of rates and getting their charges back are different.

Isn't it quite possible that one of the reasons why there hasn't been as much interest evidenced by industry, as you indicated last week, is because your program isn't geared to getting that kind of interest?

Mr. DAVIS. Well, under our program, we could certainly provide them with the research and development assistance for developing the fuel elements and the plant itself, and provide a waiver of the usage charges, whether they are for fuel or for heavy water, if this other provision is adopted. Beyond that would remain only the area of operating cost and capital cost of the plant, which are not a part of the present program.

Mr. RAMEY. Apparently, in this case, they are having a little trouble with the capital cost of the plant.

Mr. DAVIS. I have understood they were having some trouble with the financing of the plant; yes, sir.

Representative HOLIFIELD. Well, in any event, this is a project which will require further scrutiny by the Commission. We are not concerned with it this morning, particularly, except we will put it into the record. It does show an interest in this field in which, heretofore, there has been a lack of interest.

Mr. DAVIS. They have told me that their figures show that they can, with the estimated cost of building the plant, actually produce steam cheaper than they now produce it through burning conventional fuels.

Representative HOLIFIELD. That would be a very wet steam, I suppose.

Mr. DAVIS. It should be a saturated at relatively low-pressure steam; yes, sir.

Mr. RAMEY. Has the Commission conducted any feasibility studies of the construction and operation of process steam reactors comparable to what is done in, say, the maritime field or in the electric-power field?

Mr. DAVIS. I don't believe we have actually conducted any very elaborate studies. I believe there have been a number of more or less incidental studies. But the principal problem, as I outlined last week, is really not the one of being able to make the steam. You can make this steam at varying conditions of temperature and pressure by reactors that are now available. The reactors to make the steam would, presumably, be even simpler and cheaper in many cases than the ones required to make the higher pressure steam required for electrical generation.

The real problem, and the one which we have had at least two quite thorough studies on, is the problem of determining in what localities and in what sizes, temperatures, and pressures the interest for producing process steam lies. There have been, I believe, two studies on this. I believe we sent you copies of at least one of these last week.

Mr. RAMEY. We requested that from the Stanford Institute. They have made pretty general studies, though.

Mr. DAVIS. I have forgotten the total number of process and space heating plants in the country, but it is in the order of several hundred thousand. You can't do any more than try and sort out where the areas might be where one might find a profitable application.

Mr. RAMEY. There must be some gap if, as the study shows, and your remarks show, that actually your process steam type of operation uses more energy than the range of electric-power generators.

Mr. DAVIS. As I pointed out last week, the amount of heat used for this purpose is about twice as is used for electrical generation. The difference is in two related facts, really. One of them is that it is used, as I said, in literally hundreds of thousands of separate units, most of which are quite small. This, of course, is related to the second fact, which is that you can't transmit steam generated at one big station, normally, for many miles, to the places which will use it.

You have to have the steam-generating plant and the plant that is going to use it very close together. So this, in turn, is what leads to having a large number of small plants. Of course, the difficulties with the nuclear plants are that the economics deteriorate pretty fast as you go down to these small units.

Mr. RAMEY. But apparently in this case of this one small outfit, they think they could get an economic reactor working. Has there ever been any case of a group of companies getting together, like the utilities, and saying that with some Government assistance they would build a demonstration process steam reactor?

Mr. DAVIS. Well, this is the first specific case that we know of. Here again you have the difficulty that a group of companies can't use the steam as they might be able to use the electricity. It is not a transportable commodity in the sense that electricity is.

Mr. RAMEY. Well, in the case of the Florida job, you have a company participating from the Ohio Valley and providing most of the research and development, but the plant is being built in Florida. So it is not just a matter of the actual user being the participant in the project. It is sort of curious that you do not seem to be able to generate this kind of interest in a field where actually the potential demand is a good deal greater.

Mr. DAVIS. But here again I have to point out, Mr. Ramey, the need at any one place is normally not as great. I think it is largely a matter of economics. The use of 150,000 pounds an hour, which is what, I believe, Michigan Chemical is talking about, is quite a large use in new capacity at one point.

Mr. TOLL. Mr. Davis, on this $20 million, it is noted that the Carolina-Virginia project will, by itself, require almost $14 million, and the Florida project over $11.5 million. How many projects do you think this additional $20 million would take care of?

Mr. DAVIS. Well, it would depend entirely on the size of the amounts required for research and development and for the waivers of fuel use charges. If we talked about something of the sort of the Michigan Chemical proposal, I believe there their request will be relatively modest. This would take care of 3, 4, and maybe 5 proposals. If we talk about projects the size of some of these others, then it is perhaps two. But I know of no way to anticipate how many at this moment it would be except to say something like roughly 2 to 4—in that range.

Mr. TOLL. You don't have any tentative proposals as a result of informal discussions with the Commission at this time?

Mr. DAVIS. The only one I am aware of myself is the one with the chemical company at the present moment.

Mr. TOLL. With what?

Mr. DAVIS. With the Michigan Chemical Co.

Representative HOLIFIELD. Thank you, Mr. Davis.

On section 110, I would like to discuss with the Commission this project. This is the $51 million project, which is provided in the bill, project 59–d–10.

I would like to have an expression from Mr. Vance, Mr. Libby, or Mr. Graham, whichever one of you gentlemen wish to discuss this.

It has been the desire of the committee, of course, as you know, to get on with this particular type of reactor for some time. As I read this language, I note that in the bill you have written language which would make this alternatively available for a cooperative program under which the Commission might enter into an agreement of cooperation with private groups or equipment manufacturers or others, under which the organization will design, construct, and operate the reactor at its own expense, and the Commission will make certain contributions in the research and development programs necessary to construction.

At this time, do you have any information to give to the committee in regard to any tentative proposal in this field, or are you negotiating with one or more people in this field at this time to go into this in the way of a cooperative arrangement?

Mr. VANCE. I don't know of any proposal that we have; no, sir.

Representative HOLIFIELD. Have you had any inquiries in this particular area?

Mr. VANCE. Mr. Davis can answer that better than I, I think.

Mr. DAVIS. I don't know of anyone who has so far expressed more interest than just a discussion about what would be involved in terms of entering into such a project.

I would say we have not had any of what you would call even "informal discussions" on this.

Representative HOLIFIELD. You have not had informal discussions?

Mr. DAVIS. Nothing of what I would think was actually preparatory to entering into a proposal; no, sir.

Representative HOLIFIELD. In the event that this item is authorized by the committee, would it be the Commission's intent to ask for appropriations on this in their current request to the Appropriations Committee?

Mr. VANCE. Yes, sir.

Representative HOLIFIELD. How long would you consider putting this on notice before you made up your minds to go ahead on it?

Mr. VANCE. I would think, Mr. Holifield, as a matter of 2 or 3 months, so that it would not delay the work if we had to proceed with it ourselves.

Representative HOLIFIELD. In other words, you think approximately 60 days would be long enough?

Mr. VANCE. I would say 60 or 90 days. That would not delay the enterprise if we were to proceed with it ourselves without any assistance from industry.

Representative HOLIFIELD. You have expressed a policy heretofore of the Commission actually doing the work in the so-called first generation or research and development type reactors and entering into partnership with other groups on second or third generation type of reactors.

How would you classify this particular project, as a first, second, or third generation?

Mr. VANCE. I personally would classify it as a second or third rather than a first generation. Maybe first generation as far as we are concerned, but we have enough basic information with regard to Calder Hall, and reactors of that type that have been built or are being built by our British friends, so that I would not say that this project is a first generation in the true sense of that phrase—the true meaning of that phrase.

Representative HOLIFIELD. We are sure we have information on the Calder Hall, but this, we would hope, would be an advanced type over the Calder Hall.

Mr. VANCE. That is right.

Representative HOLIFIELD. It would seem to me that this would be a first generation type of reactor.

Mr. VANCE. I wouldn't say so. I would think Mr. Davis' opinion would be better than mine on this.

Representative HOLIFIELD. How would you classify it, Mr. Davis?

Mr. DAVIS. My opinion would be that it would be about one and a half generation.

Representative HOLIFIELD. What would you consider it, Dr. Libby, one and three quarters?

Mr. DAVIS. May I explain what I mean by that, Mr. Holifield?

Representative HOLIFIELD. I wish you would. I would hate to leave a one and a half generation.

Mr. DAVIS. I think when it comes to the construction of the physical plant itself, in other words, the graphite, the shell, the heat exchangers, and the physical plant, the information that we have from other projects and from the British is quite adequate so that that part of it, so far as I am concerned, could probably be called a second generation plant. On the other hand, what we are going to endeavor to do is to go to higher temperature fuel elements, which are not types that the British have used in Calder Hall. In this respect, in putting in various batches of fuel elements, which one can do in your second generation reactor, you are really carrying out first generation experiments. This is why I said it was sort of a one and a half generation reactor.

In one respect it is really a first generation reactor and in the other, where we are trying to push for higher type fuel elements, it is much more advanced than Calder Hall, on which we have the information.

Representative HOLIFIELD. I think the committee would not want to go on record as conceding that this would be a second or third generation reactor. We have not built anything in the way of a pilot plant or prototype plant in this field.

There is technology developed in this field, as we know, by the English, and this might give us certainly a position of advantage as to the application of known technology. But in envisioning an advanced type of reactor certainly it would be in the experimental field, and research would be necessary to take the technology which has been developed, not only in the Calder Hall type of plant, but the metallurgy and all the other corresponding field, and embodying it in a reactor that we are talking about, the type of reactor which would seem to me to bring this peculiarly within the field of a first generation, from the standpoint of research and development.

Mr. DAVIS. What I would say, Mr. Holifield, is that it is not as clear a case as being a first generation as some other type might be, for the reasons I have mentioned.

Representative HOLIFIELD. Certainly we could not start off with thinking that this would be a reactor which could be put on a power-line as a steady producer of power.

It would have to be in the experimental field, both its postconstruction operation and maintenance—and I would not mean for this to preclude the utilization if it turned out to be highly successful, but at this stage of the game, looking at that from this time, its primary value would be in exploring a new field.

Mr. DAVIS. Yes, but as I outlined the other day, this is not the kind of reactor where we would expect to be shutting it down and starting it up all the time or changing fuel elements every week or even every month. If we get the type of life out of the oxide fuel elements that we would contemplate, the fuel elements would be in the reactor for some thing like 6 or 7 years before they would be discharged. So this is, by its very nature, even though it may be considered experimental, a long-term operation. In fact, if you say it is going to cut off 5 years after it starts operation, you will not even be able to carry the fuel elements to the life which they would have to have in order for it to be economic.

It is not the kind of experiment in any sense that has been conducted with the so-called reactor experiments. I think perhaps it illustrates the fact that you really can't make too valid generalizations about this kind of thing.

Almost every reactor is a case unto itself and has to be looked at individually.

Representative HOLIFIELD. So at this time you have no projected participant in this field, and it would be the general thinking of the Commission that a 60 day listing on this would be enough time to allow people to indicate an interest or not.

Mr. DAVIS. Could I repeat what I said last week, Mr. Holifield, that it is not contemplated that the actual construction would start before early 1959, and we would not, in fact, on this reactor, even have the preliminary design completed until the middle of August.

Representative HOLIFIELD. Middle of August of this year. And we would then go forward with a detailed design, in any case, which would take at least the following year, to wrap up the detailed design.

Mr. DAVIS. So that the time period which could be allowed here could be fairly substantial without in any way interfering with the going ahead with the project on the time scale as we see it now anyhow.

Representative HOLIFIELD. And if there was a dragging of the feet on the part of the Commission in developing this, in aggressively developing the design detail, it would result in a further delay on this matter.

Mr. DAVIS. We are going ahead with the development work in any case. We are proceeding at the present time with title 1 or preliminary design of this plant. We will initiate in August, or as soon as people become free from the preliminary design, the detailed design. Construction can't start before next year anyhow. What I am trying to say is that we are going ahead here quite solidly. The time for

securing industry participtation can be fairly substantial without interfering with the project itself.

Representative HOLIFIELD. And the Commission is in accord with what Dr. Davis has said, that an aggressive program will be initiated by the Commission, as far as the design and pinning down the details and that sort of thing?

Mr. VANCE. We would expect to start immediately after the project is authorized. We would expect to start immediately on the assumption that we would not get a proposal from industry and that we would have to build it.

Mr. DAVIS. As a matter of fact, Mr. Vance, it is going ahead at the present time.

Representative HOLIFIELD. The subcommittee will meet again tomorrow afternoon at 2 o'clock. The room will be designated. It will probably be in this room. There will be no meeting this afternoon.

The meeting is adjourned.

(Whereupon, at 12:10 p. m., Tuesday, June 10, 1958, the hearing was recessed, to reconvene at 2 p. m. Wednesday, June 11, 1958.)

AEC AUTHORIZING LEGISLATION

WEDNESDAY, JUNE 11, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to recess, at 2:30 p. m., in room 304, Old House Office Building, Hon. Chet Holifield, chairman of the subcommittee, presiding.

Present: Representatives Holifield (presiding) and Hosmer.

Also present: James T. Ramey, executive director; David R. Toll, staff counsel; R. N. Nelson, staff technical consultant, Joint Committee on Atomic Energy, and Bernard V. Dvoskin, GAO consultant.

Representative HOLIFIELD. The subcommittee will be in order.

The Subcommittee on Legislation of the Joint Committee on Atomic Energy is meeting this afternoon in public session to continue hearings on the AEC authorization bills.

This afternoon we are scheduled to hear from three groups of witnesses who have requested permission to appear before the committee. First we are scheduled to hear from Mr. Raymond C. Freeman of the General Electric Co. concerning the proposed test reactor at Vallecito, Calif.

Secondly, we are scheduled to hear from Mr. S. L. Descartes of Puerto Rico Water Resources Authority.

Our third witness will be Mr. Benjamin C. Sigal, general counsel of the International Union of Electrical Radio and Machine Workers, AFL-CIO, concerning the PRDC case.

Our first witness this afternoon is Mr. Freeman.

Mr. Freeman, will you proceed?

STATEMENT OF RAYMOND C. FREEMAN, ATOMIC PRODUCTS DIVISION, GENERAL ELECTRIC CO.

Mr. FREEMAN. Mr. Chairman, my name is Raymond C. Freeman. I am an engineer, and have been associated with General Electric since 1929. In the past I have served as engineering manager of General Electric's atomic power equipment department. This department is located in San Jose, Calif., and is responsible for the company's commercial atomic-power activities. At present I represent this department in Washington.

General Electric shares with the Joint Committee and the Atomic Energy Commission a deep interest in the availability of adequate test reactor capacity. We are pleased to accept the invitation of the chairman of this subcommittee to submit information regarding the construction and operation of test reactors.

The photographs attached to this testimony show the 30,000-kilowatt General Electric test reactor, known as the GETR, which we are building with our own funds at the General Electric Vallecito Atomic Laboratory near Pleasanton, Calif. This is a high-flux reactor especially fitted for nuclear fuel development work. It is suitable for both basic research and for engineering development and test programs. It is a flexible reactor; test loops for boiling water, for pressurized water, sodium, gas or organic fluids can readily be installed.

In addition, there are large low-flux areas suitable for materials testing. This reactor is supported with hot laboratories and other laboratory, metallurgical and shop services at the Vallecito site.

The primary purpose of the GETR is to develop fuel for the Dresden power reactor. However, there is a considerable amount of space available for other uses.

The GETR is scheduled to be started this fall and to be in regular operation in December. Irradiation service has been and is publicly offered at prices competitive with the existing test reactors, the MTR and the ETR at the National Reactor Testing Station in Idaho. In spite of the reported critical shortage of test reactor capacity there is not at this moment a single firm commitment from the AEC or its contractors for the use of this test reactor.

Westinghouse also is constructing a test reactor; I do not have information as to the extent to which its services are committed.

Industrial Test Reactors, Inc., of Charlotte, N. C., recently announced plans for constructing a 50,000-kilowatt test reactor. This facility would be second in size only to the ETR. To the best of my knowledge, no firm commitments have yet been made for the services of this reactor.

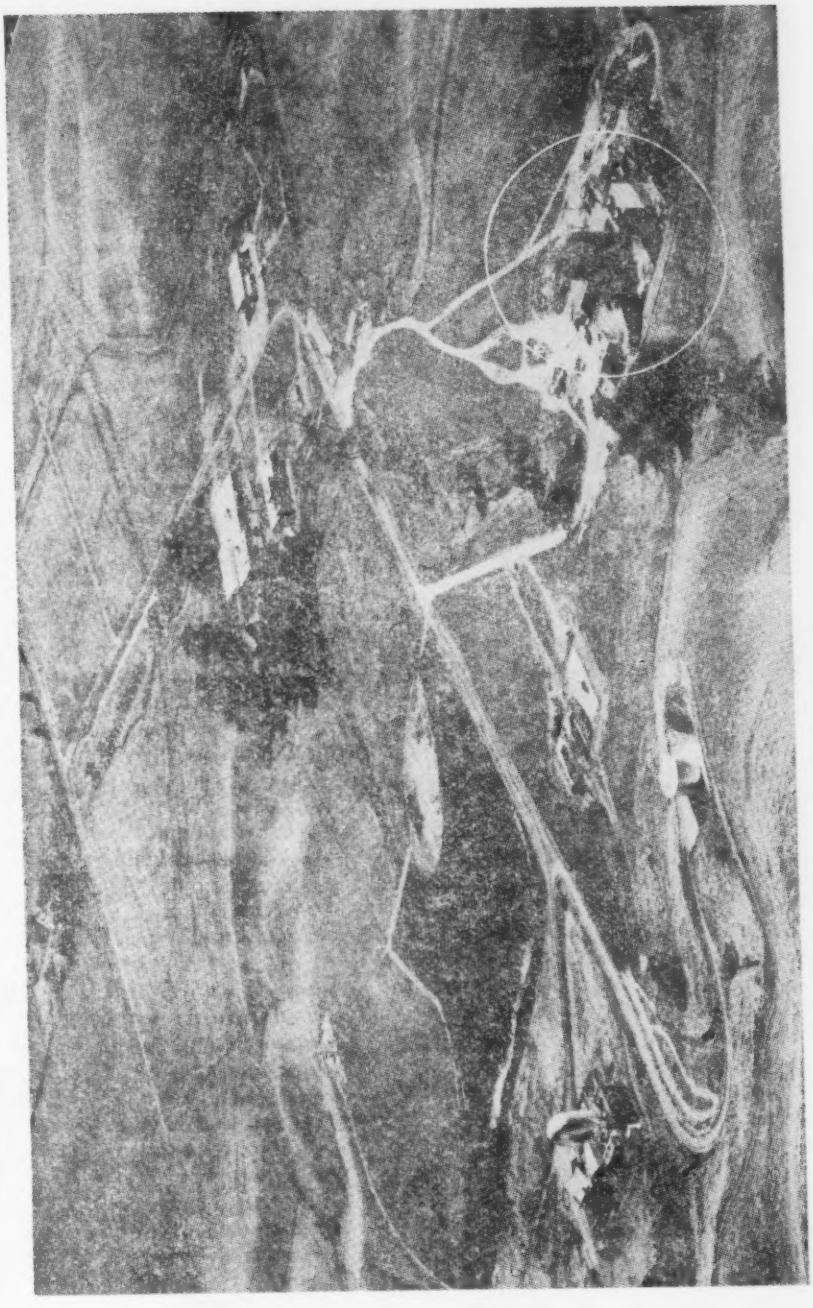
A major portion of our country's irradiation needs are connected with Commission programs. Under present practices contracts for these needs are made on a year-by-year basis. Thus any private group which considers building a test reactor is faced with the fact that no long-term commitments are available from the Commission.

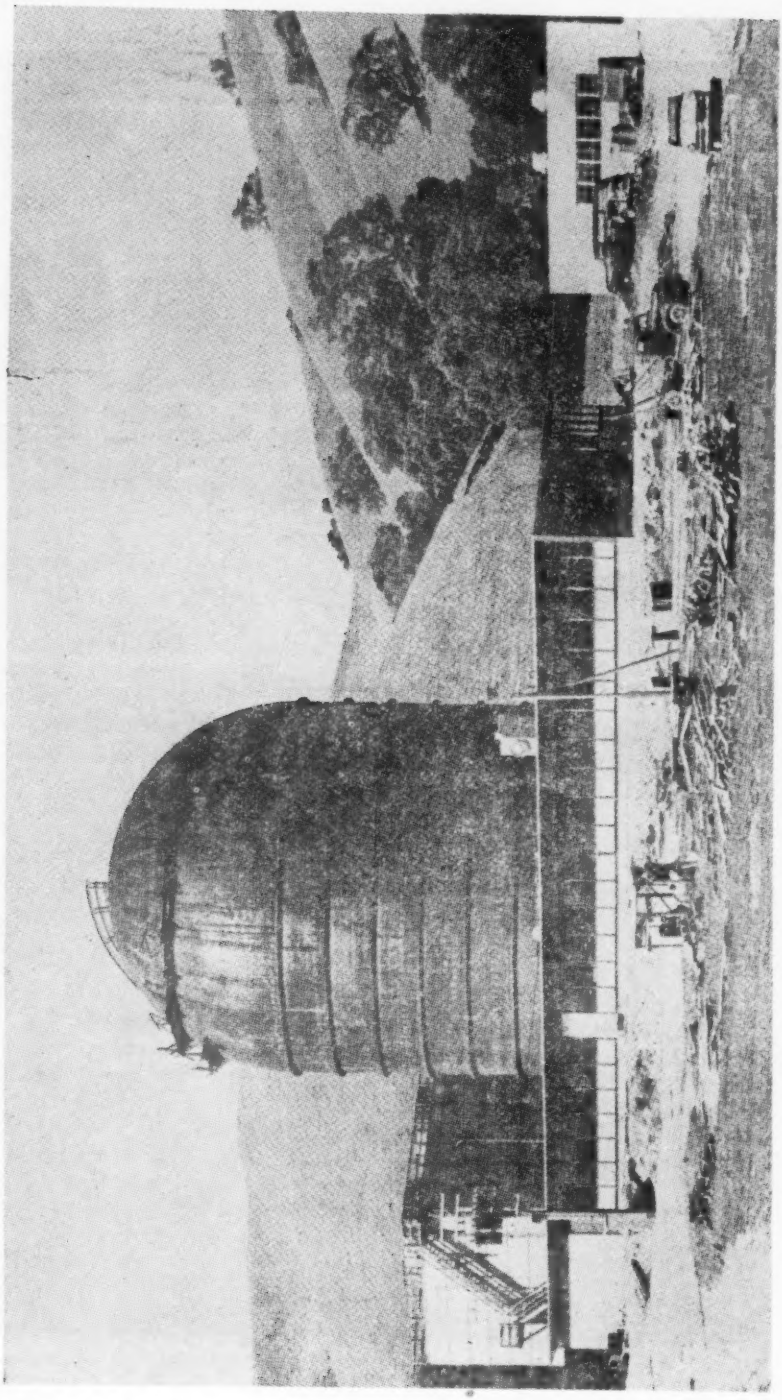
A major irradiation program may require 2 or 3 years for completion. Approximately 1 year of this time is required for the construction of a major test loop in a test reactor. A month or more should be allowed for checking out the operation of the loop. Only then can the actual irradiation program begin.

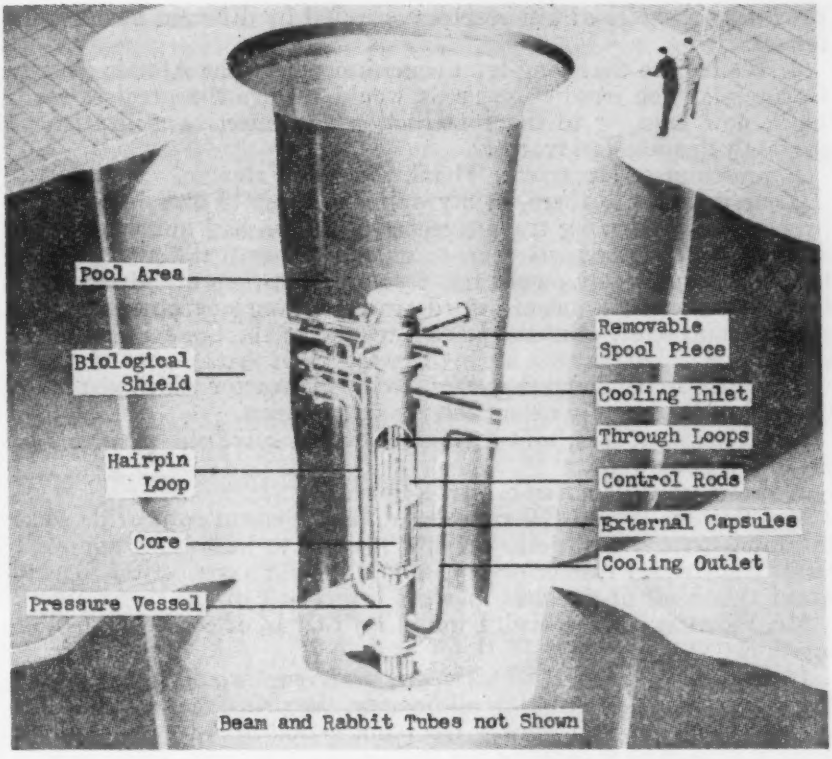
If the AEC were in position to make long-term commitments for periods at least commensurate with the duration of major irradiation programs, one of the greatest roadblocks to the construction of privately financed test reactors would be removed.

The preservation of trade secrets is a genuine problem in the conduct of irradiation programs for private customers. This problem exists whether the reactors be privately owned, or Government-owned and operated for the Commission by contractors. In either case, safety and operating considerations require that an extensive disclosure be made to the reactor operators of the nature of materials to be used and experiments to be performed.

We believe that reasonable steps can be taken to provide adequate protection for the trade secrets of irradiation customers. Similar problems have been met successfully in connection with the activities of other kinds of testing and laboratory activities.







The importance of the proprietary information problem is likely to vary considerably from case to case, depending primarily on the nature of the work and the business interests of the reactor operator and the irradiation customer. Perhaps the best answer to the trade secrets problem is to provide companies needing irradiation service with a choice of test reactors operated by different business concerns.

For example, a company which may be reluctant to have its irradiation work performed in a test reactor run by a direct competitor is not likely to object to having irradiation conducted in a reactor run by a company in another industry, or by an independent company engaged exclusively in test reactor operations.

Insofar as the Commission's own irradiation programs are concerned, there should be little difference from the proprietary information standpoint, between having work done in a privately owned reactor or in a Government reactor operated by a private contractor.

In summary, there are four points:

1. At least 2 privately financed test reactors are now under construction; plans for at least 1 other have been announced.

2. Experience in seeking commitments for the services of the GETR raises a question as to the reality of the reported shortage of test reactor capacity.

3. The problem of preserving trade secrets exists similarly in the cases of privately owned reactors and Government-owned reactors operated by private contractors. The problem can best be solved by

providing a choice of test reactors operated by different business interests.

4. We believe that long-term commitments by the Atomic Energy Commission for irradiation needs would remove the greatest roadblock now existing to the construction and effective utilization of privately financed test reactors.

Representative HOLIFIELD. Thank you, Mr. Freeman.

Your item No. 3 there, in my opinion, seems to oversimplify the problem of preserving trade secrets. We have had quite a number of different industrialists come to us and tell us that they are loath to use these privately owned test reactors, that they would rather go to one of the Government-owned reactors, even one operated by a private contractor. But the present request of the Commission is for $27 million which they can use in this way. So if that amount of money was granted to them and they chose to use the reactor which you built, that would to a certain extent solve your problems.

Mr. FREEMAN. Yes, and I think it would solve the problems of many others as well.

Representative HOLIFIELD. Mr. Ramey.

Mr. RAMEY. Would GE consider an arrangement to provide some assurance on the proprietary rights business to have some nonprofit outfit run the test reactor or to handle a test for a competitor so as to avoid this kind of problem and get utilization of the test reactor?

Mr. FREEMAN. In general, I would say that is, of course, a possible solution.

In the case of General Electric, our preference would be to operate the reactor ourself because in all honesty, the prime reason for building it is to do our own work. The point is that in order to get a flux density as high as is required for fuel development, one has to build a reactor whose size is larger than our load of work will require.

Representative HOLIFIELD. Then you would have a great deal of idle time?

Mr. FREEMAN. Yes.

Representative HOLIFIELD. What percentage of time would you have in this reactor that was idle?

Mr. FREEMAN. At the present time, I should say that not more than 25 percent of the capacity of the GETR is required by General Electric's own present programs.

Representative HOLIFIELD. What is that percentage?

Mr. FREEMAN. Not over 25 percent.

Representative HOLIFIELD. So you have about 75 percent idle time?

Mr. FREEMAN. Approximately that. That might vary from time to time over a period of years.

Representative HOLIFIELD. You speak of long-term commitments. What do you mean by that?

Mr. FREEMAN. I should say that a 5-year period would be long-term.

Representative HOLIFIELD. With an open end as to how much they would need?

Mr. FREEMAN. It could be open end; yes.

Mr. RAMEY. On the problem of long-term commitments, the Commission sent up some proposed legislation near the end of the last session of Congress and indicated that they will send some revised proposed legislation in the next few weeks to cover this sort of long-term obligation.

Mr. FREEMAN. That would sound very constructive to me.

Representative HOLIFIELD. Thank you very much.

Mr. FREEMAN. Thank you, sir.

Representative HOLIFIELD. Our next witness will be the witness from Puerto Rico.

I see Dr. Fernós-Isern is here. He is the Delegate from Puerto Rico.

Mr. FERNÓS-ISERN. Mr. Chairman, I have the honor to present to you the head of the Water Resources Authority of Puerto Rico, Mr. Descartes, who will testify on the Puerto Rico power reactor project.

Representative HOLIFIELD. Thank you. We are glad to have you here today.

Dr. Zinn, will you come up, too?

STATEMENTS OF S. L. DESCARTES, EXECUTIVE DIRECTOR, PUERTO RICO WATER RESOURCES AUTHORITY; AND DR. WALTER L. ZINN, PRESIDENT, GENERAL NUCLEAR ENGINEERING CO., PUERTO RICO POWER REACTOR PROJECT

Representative HOLIFIELD. First, I will insert in the record a letter dated June 6, 1958, from Mr. Descartes to Chairman Durham. Mr. Descartes, you have a prepared statement here.

(The material referred to follows:)

PUERTO RICO WATER RESOURCES AUTHORITY,
San, Juan, P. R., June 6, 1958.

Hon. CARL DURHAM,
Chairman, Joint Congressional Committee on Atomic Energy,
Washington, D. C.

DEAR CONGRESSMAN DURHAM: This letter is in response to a request that we furnish the Joint Committee on Atomic Energy with information as to the current status of plans for a nuclear reactor project which would be a part of our power system in Puerto Rico.

As you know, the Atomic Energy Commission (AEC) and the Puerto Rico Water Resources Authority (PRWRA) have been engaged in discussions of such a project for a period of nearly 2 years—that is, since the subject was first raised with us by AEC in August 1956. Last year the AEC included such a project in its budget. Funds for the project were deleted by the Joint Committee from the authorization bill, but the Joint Committee accompanied this action with a statement to the effect that approval of the project was not required "at this time".

We interpreted last year's action by the Joint Committee as an indication that the general purposes of the project were considered to be meritorious; that congressional authorization would probably be forthcoming when the project was presented in a more concrete and immediate form, and that one purpose of the Joint Committee was to offer affirmative encouragement for moving the project along to a more advanced stage.

On this basis we have continued during the intervening period to explore the matter more intensively, both with the Atomic Energy Commission and with qualified persons and firms on the outside. Recent developments have been exceptionally encouraging, and accordingly, we welcome this opportunity to inform you in more detail as to where the matter stands today.

From the beginning we have been aware of the desirability that a project such as this must be carried out in a way which would be of benefit to the general atomic energy program of the United States, and would at the same time fit in with the situation which exists in Puerto Rico. For one thing, this has required us to keep in mind the limited nature of the financial contribution which PRWRA would be able to make to the project. Nevertheless, despite the limitations which the economy of Puerto Rico and the rapid growth of its power requirements place upon our capital resources, we advised the AEC that PRWRA stands ready to contribute $1 million toward the total costs of such a project.

As you know, PRWRA constitutes an expanding, integrated and progressive power system. Its present capacity is 350,000 kilowatts, with an expected rate capacity of 680,000 kilowatts by 1961. The PRWRA system is essentially the source of the entire power supply for Puerto Rico. Our island location, our relatively high fuel costs, and our dependence on fuel imports, present a situation in which the possibilities of nuclear power are of especial interest for the future.

We are aware, also, that a successful nuclear project in Puerto Rico would be of considerable benefit to the United States as a whole, in serving as a demonstration for Latin American areas and in affording to the United States another significant opportunity for leadership.

During the past year we have been particularly interested in the possibility of selecting for a Puerto Rican nuclear power project some particular type of reactor of improved design—a reactor type which would be recognized on all sides as making some real contribution to the United States reactor program as a whole.

After considerable exploratory discussion, Dr. Walter H. Zinn has submitted to us a proposal for a nuclear superheated boiling water reactor. He considers this to be of great promise to the atomic energy program, and we concur in his judgment that it would be well suited to conditions here in Puerto Rico.

We requested Dr. Zinn to prepare a written summary, outlining the technical and other advantages of this type of reactor project, and its suitability to Puerto Rican conditions. We have just received this from Dr. Zinn and a copy is enclosed for your information. Copies have been made available to Mr. Davis, Director, Reactor Development Division of the AEC.

A further meeting is scheduled to take place with the AEC this coming Wednesday.

In this letter, I have sought to outline the main points of interest concerning the current status of our plans, rather than to emphasize matters of detail. Any further information which might be of use to you or other members of the Joint Committee will of course be furnished.

Cordially yours,

S. L. DESCARTES,
Executive Director.

Mr. DESCARTES. Yes.

In the name of the Governmento f Puerto Rico, of Governor Muñoz-Marín, who is also chairman of the governing board of the water resources authority, of the other members of the board, and personally, I would like to express the interest of the Government of Puerto Rico in cooperating with the Federal Government in furthering the nuclear development program for peaceful uses.

We have faith in the use of the atomic energy for the production of power, and from the start have kept informed and have trained already six persons in nuclear science. We were most encouraged that the Commission and the Congress of the United States have approved the establishment of a nuclear training center at the University of Puerto Rico.

The water resources authority, which is a publicly owned electric utility, serving essentially the entire island of Puerto Rico, looks forward with enthusiasm to participating in this program.

As I expressed to the Honorable Carl Durham, chairman of the Joint Congressional Committee on Atomic Energy, in my letter of June 6, 1958, the Puerto Rico Water Resources Authority and the Atomic Energy Commission have been engaged in discussions of a nuclear power project for a period of nearly 2 years since the subject was raised with us by the Atomic Energy Commission in August 1956. Last year the Atomic Energy Commission included such a project in its budget requests.

We interpreted last year's action by the Joint Committee as an indication of their desire to have a specific proposal of a given type of nuclear reactor. On this basis we have continued to work during the

intervening period to explore the matter more intensively, both with the Atomic Energy Commission and with qualified persons and firms.

In the course of the last 2 years we have considered various concepts presented to us by various manufacturers. As a result, we have presented to the Atomic Energy Commission a proposal on a project for a boiling water reactor with a nuclear superheat. This proposal is based on a preliminary study which has been prepared for us by Dr. Zinn and his company, General Nuclear Engineering Corp.

Dr. Zinn has stated that adding a nuclear superheat is the most important next advance which can be made for water reactors.

We believe this project is well suited to conditions in Puerto Rico and that it will make a contribution to the Federal Government's program of the development of nuclear power for electric generation.

Within the terms of its economic possibilities, and with due regard to other pressing needs, the water resources authority is prepared to make a reasonable contribution to this project. We could not undertake obligations of open-ended nature, in terms of either the investment or the operating costs of the nuclear reactor. But within these limitations our intention and our desire to make a real contribution to the costs of this project are clear from the discussions we have been having with the Atomic Energy Commission and from the proposal we have submitted.

We believe that, in addition to the development of another advanced nuclear reactor concept, there are also other reasons why the establishment of this nuclear reactor in Puerto Rico will be advantageous to the progress of the nuclear-power program of the United States.

The fact that the reactor will be established in an area separated by 1,000 miles from Miami and 1,600 miles from New York will require attention and planning in respect to the construction and other technical aspects pertaining to nuclear reactors which will have significance when such a program is applied to other areas distant from the mainland of the United States.

For example, the economics of the handling and shipping of irradiated elements for reprocessing will receive a significant test.

In addition, this will be a nuclear reactor that would be tied up to an integrated electric system serving the entire community of Puerto Rico. The system serves nearly 360,000 customers, 120,000 of which are in the rural areas, through an installed capacity of approximately 360,000 kilowatts, generating over a billion and a half kilowatt-hours a year. It is an integrated system composed of hydro plants, steam plants, and very soon we will use gas turbines.

The Puerto Rico Water Resources Authority began its power operations in 1915. It has now grown to become a system which is about 30th for the entire United States as measured by the number of consumers served. It is about 50th in terms of electric plant, and ranks among the first 100 in terms of energy output. It is self-sufficient, and it gets its financing through the sale of revenue bonds, of which there are now about $160 million outstanding.

The average experience of our eight heads of divisions with the authority is over 20 years. Since 1955 we have trained 6 persons in nuclear sciences, of which 1 has obtained a doctorate in philosophy in nuclear engineering. A mechanical engineer received a year of

training at the Argonne Laboratory and a year of on-the-job training with the experimental boiling water reactor at Argonne.

One of our nuclear trainees received a master of science in nuclear engineering from the College of Engineering of New York University, and another will finish one next year. We have a chemical engineer who will complete his course this summer at the Oak Ridge School of Reactor Technology.

Last month another trainee was 1 of the first 4 to receive the degree of master of arts in nuclear engineering from the newly established nuclear science program at the University of Puerto Rico.

This makes a well-rounded group of 3 electrical engineers, 1 mechanical engineer, and 1 chemical engineer, all with special training in nuclear technology.

Our system has been growing for the last 3 fiscal years, including the one that will end on June 30, at an average rate of over 18 percent, which means a total growth of about 65 percent in 3 years. This has made it necessary for our system to increase its installed capacity at an average yearly rate of from 40,000 to 50,000 kilowatts. Our program contemplates almost duplicating our present installed capacity by the year 1961.

Our actual capital expenditures this year will amount to $30 million. We have on order 3 generating units of 82,500 kilowatts minimum nameplate rating.

The PRWRA does its system planning, and our engineering division does the civil engineering for our projects as well as the supervision and coordination of the electrical and mechanical design provided by our consulting engineers. PRWRA supervises the actual construction which has been done by different contractors.

This nuclear reactor installation would also be a very useful adjunct to the rounded operation of the nuclear training center which has been authorized by the Commission and the Congress in Puerto Rico. The students at the center, as well as observers who come from other countries, might observe the operation of a nuclear reactor tied up to an operating electric utility.

The government of Puerto Rico has been extremely interested in aiding, in its own modest way, the point 4 and other technical training programs of the Department of State and other agencies of the Federal Government.

For example, we have had in Puerto Rico over 5,000 visitors from over 100 countries since May of 1950. Of these people, nearly half have come from Latin America. The rest have come from such areas as Africa, 140; the Near East, 114; South Asia, 130; Europe, 94; and the Far East, 700, and the Caribbean, 749.

Governor Muñoz-Marin has several times stated that one way in which the people of Puerto Rico can show their appreciation of the opportunities and advantages which they have enjoyed in their economic development program as a result of their association with the United States is to help publicize to the world, in these trying times, what can be achieved in economic development under democratic methods. He has stated that the people of Puerto Rico cannot contribute with large amounts of money, but we have annually made appropritaions to help make the life of these visitors more instructive and agreeable while in Puerto Rico, and to help them get a better idea of the programs now being carried out.

The water resources authority itself, as part of this overall policy to help in Federal programs of aid to other countries, has signed contracts to provide for technical training and exchange personnel with the power agencies of the States of Minas Gerais and Goiaz in Brazil.

Our chief engineer has made surveys and reports, at their request, to the official agencies entrusted with the development of water power in the Republics of Panama and Costa Rica. We keep close relations with the Institute of Electricity of the Republic of Cosa Rica. Qualified personnel in the authority visit and help train engineers from the countries and have made contracts with us. We receive for short and longer training periods many technicians from other countries who come to Puerto Rico through the International Cooperation Administration program.

May I express today my personal appreciation, and that of the people and the government of Puerto Rico, for the interest of the Congress of the United States in furthering the development of this important source of economic power, that may be so useful throughout the world, in raising levels of living?

Representative HOLIFIELD. Thank you, Mr. Descartes, for your statement.

The committee last year disapproved an item which had to do with the building of a reactor in Puerto Rico, because at that time we thought the proposal was not specific enough and that it did not give the committee the information it needed to indicate, if an authorization was passed for the reactor, that it would be of an advanced and valuable type in the advancement of the art. It was without any idea of discrimination against that particular item, but for those reasons.

The Chair has been informed that you have made a proposal as of this morning to the Commission.

Mr. DESCARTES. Yes, sir.

Representative HOLIFIELD. And in due time, no doubt, that will be brought before us for consideration, and it will receive careful consideration.

Do you have anything to say at this time, Dr. Libby?

Mr. LIBBY. I am very pleased that the proposal has come in. I look forward to seeing it. I have not seen it.

Mr. DESCARTES. Mr. Chairman, we have Dr. Walter Zinn with us and he may cover some highlights of the technical aspects of the proposal if you would like to hear him.

Representative HOLIFIELD. Dr. Zinn, if you want to summarize very briefly, but we will not go into detail at this time on this because it would be more proper when the proposal is brought before us by the Commission.

Mr. ZINN. Mr. Holifield, I appreciate the opportunity to summarize. I especially appreciate the privilege to be brief since I am not prepared.

I would like to say that my company got into this because the water resources authority some months ago asked us if we could suggest to them a reactor suitable for installation in Puerto Rico and which would be an advance in the art, and which would presumably be acceptable as part of the overall program of the Atomic Energy Commission.

We reviewed various concepts of small- and intermediate-size reactors, and after due consideration decided to propose that the reactor be a boiling water reactor in which we add superheat in the reactor core

itself. This is not a really new idea. I think we first had it in 1953 when we first made a reactor boil.

It is not any easy concept to envisage in its entirety and to really know that it is in fact practical. A study must be performed.

The first phase of the proposal that we have made to the water resources board or authority, and which they have made to the AEC, is that there be a 9 months' study of this question.

I will briefly say what the question really is by recounting a little history. Way back in 1942, when water was first used to cool a reactor, there was a great deal of concern about the fact that if the water boiled and made bubbles or voids, it would cause instabilities in the reactor. So an overpressure was used to prevent the boiling. The same idea was carried forward in the Nautilus prototype, where an overpressure is used.

But in 1953, we got the idea that maybe this was not a necessary condition for a water reactor, and we allowed the water to boil and therefore to have voids. This is, I believe, generally accepted now as a process that works. The steam which is formed in one of these reactors at a temperature of about 550° F. is wet steam, and therefore does not fit in very well with a normal turbine which wants very dry steam in order to prevent erosion and so on in the turbine.

Of course, the turbine manufacturers, by adding certain features to turbines, have been able to handle the moisture but with some expense. We are now suggesting that, in addition to making the steam, which will be saturated steam, we then pass it through a certain part of the core of the reactor and superheat it to perhaps 900° F., which then would be steam equivalent to what is ordinarily used. But just as soon as this is done, you have a reactor which not only has voids in it due to the steam in the boiling water, you now have a void—a gas space in fact—where the superheated steam passes through the reactor. So you have part of the reactor cooled by what is essentially a gas and part in which the water is boiled.

This is a rather formidable reactor physics problem and has not been studied, to my knowledge, in any detail. We think there is a fair probability that the study will give a favorable answer and that such a machine can be built successfully.

Furthermore, we believe that when built and tested and found to be successful, it will be a real advance in the business. I think for that reason the Atomic Energy Commission is interested in seeing it tried out in what is essentially a reactor experiment.

We also believe that it is practical to design a reactor in which the gear or the hardware which is involved in the superheating can be removed and the reactor operated as a normal or conventional boiling water reactor if it is found that the superheating feature falls short of what you would like to see for either economic or technical reasons.

So the proposal we have made to the water resources authority is that they make this important test and that no matter how the results of the test come out, they will have an operating nuclear powerplant which will be very useful to them for the reasons that Mr. Descartes discussed.

Representative HOLIFIELD. What size plant is this contemplated to be?

Mr. ZINN. This should be a matter for the study, but our present notion is that it be a 15 electrical megawatt plant. If you care to see

a sketch which shows how it looks on the inside, I would be glad to show it to you. I have the sketch here.

Representative HOLIFIELD. We will look at that later, I think. You may pass it up if you wish.

Do you have a question, Mr. Toll?

Mr. TOLL. Is the wet steam led back in through a pipe into the internal parts?

Mr. ZINN. There are a number of ways of doing this. I will not recite them all. These must all be examined to find which is feasible or which is the better one or the best one. In every case in our view you must take the saturated steam through the same reactor core. We are not proposing to build 2 reactors, 1 a boiling reactor and 1 a steam-cooled reactor. That can be done. But that is not the same problem we are facing here.

Mr. TOLL. The steam is not radioactive; is it?

Mr. ZINN. Not any more so than it is in the open cycle boiling water reactor. The experience with the reactor at Argonne and the experience with the reactor at Vallecitos indicates that this is not a serious problem. It is tolerable and acceptable.

Mr. TOLL. There would be no heat exchanger in this system?

Mr. ZINN. We would prefer not to. We think we get a better plant without a heat exchanger. It is possible to add a heat exchanger even in this case.

Mr. TOLL. Then you would lose the value of your superheated steam?

Mr. ZINN. No; you could use that steam to superheat some of the steam that you made in the heat exchanger.

Mr. TOLL. If you superheat it enough?

Mr. ZINN. Yes; but it is not as good.

Representative HOLIFIELD. Thank you very much, and we will be anxiously looking forward to getting the details from the Commission.

Mr. DESCARTES. Thank you.

(Subsequently the AEC issued the following press release on June 20, 1958:)

[Press release No. A-148, Friday, June 20, 1958, issued by U. S. Atomic Energy Commission, Washington, D. C.]

AEC CONSIDERING PUERTO RICAN PROPOSAL FOR 15,000-KILOWATT POWER REACTOR

The Atomic Energy Commission has under consideration a proposal of the Puerto Rico Water Resources Authority for the construction of a 15,000 kilowatt boiling water power reactor. The reactor would cost approximately $11 million and would be used in the Puerto Rican electric system.

Puerto Rican authorities stated that the reactor would be a useful adjunct to the Puerto Rico Nuclear Training Center. The center, a Commission installation operated by the University of Puerto Rico, is being established to make Spanish language instruction and training in nuclear science and technology available to the Latin American Republics as well as to the island commonwealth.

A feature of the proposed reactor, designed by the General Engineering Corp., Dunedin, Fla., is that the possible use of nuclear superheat is contemplated. The Commission now has in progress nuclear superheat feasibility studies to determine the economic benefits to be gained by using superheating to attain higher temperatures.

Under the Puerto Rico proposal, the Commission would supply the major share of the funds for the reactor, including the research and development costs for superheat feasibility. The Commission would retain title to the reactor.

Representative HOLIFIELD. Our next witness will be Mr. Ben Sigal, general counsel of the International Union of Electrical Radio and Machine Workers, AFL–CIO.

STATEMENT OF BENJAMIN C. SIGAL, GENERAL COUNSEL, INTERNATIONAL UNION OF ELECTRICAL RADIO AND MACHINE WORKERS, AFL–CIO

Mr. SIGAL. Mr. Chairman, I appreciate the opportunity to appear before you this afternoon. Due to the short notice I regret I have had no opportunity to write my statement. I can do so later, if you wish.

It is my understanding that the Atomic Energy Commission has sought an authorization in section 109 of the bill pending before you in the amount of $4,309,000 for the PRDC project.

The Commission says, however, that, inasmuch as they have already received authorization for $1.5 million, all they need now is the additional authorization of $2.8 million.

Now, it is our contention that AEC never received an authorization of $1.5 million for the PRDC project, and, for the reasons I will state, it is our position that the AEC should not receive any authorization at this time applicable to the PRDC project. I should like, just to bring this matter into focus, give a little history of this matter.

About a year ago, or a little over a year ago, the Atomic Energy Commission entered into a development contract with PRDC, in which they undertook to spend $4,450,000 in connection with a project for which PRDC was given a construction permit. As a result of the fact that the issuance of that permit was challenged, and that the hearing was pending before the Commission as to the validity of that construction permit, Congress did not authorize any money for the execution of that contract. I should like to refer you to just a portion of the legislative history.

On July 31, 1957, the Joint Committee reported out authorizing legislation for Commission appropriations. In that report, at page 19, the committee stated as follows:

> The committee does not approve the construction, research and development work and waiver of fuel use charges in connection with the reactor project of Power Reactor Development Company since legal proceedings before the AEC to determine the probable safety of the proposed reactor are still pending.

Now what Congress did was to appropriate $1½ million for the following purpose, and I quote:

> Funds in the amount of $1½ million may be expended for additional general research and development in Commission laboratories to advance the technology of the fast breeder reactor concept.

That was the entire purpose of the grant of $1,500,000. It is clear, I think, from the legislative history that it was not intended that this million and a half dollars be used for purposes directly related to the PRDC project, but was to be used for the purpose of advancing the technology of the fast reactor concept.

Simply for your further reference, in case you desire, I call your attention to the following pages of the Congressional Record for 1957, in which the intentions were pretty clearly spelled out; namely, pages 12444, 12862, 12863, 13710, and 14159.

After this was done, it became clear that the Atomic Energy Commission intended to ignore the limitations imposed upon the use of

that million and a half dollars. This came more or less officially to our attention when counsel for AEC staff in the PRDC hearing stated in their brief, in response to an argument that I had made in this matter—this is at page 141 in the brief of AEC in that case—refering to this appropriation they say:

> These funds are available for research and development directly related to the PRDC project.

Then in a reply brief they expand on that statement and tie it even more closely to the PRDC project with this statement, which appears on pages 25 and 26 of their reply brief:

> The 1.5 million appropriated by Congress, while not available for expenditure under the PRDC contract, is clearly intended to be available for research and development directly related to and primarily useful to the PRDS project.

Now I say, Mr. Chairman, there is not a word in the record to justify that conclusion or the use of the money for the purposes for which AEC is clearly using it.

PRDC itself, in a statement submitted to this committee on March 4, 1958, indirectly corroborated the statement that I am making to you. This statement was submitted to the Joint Committee in connection with the 202 hearings and is simply called Statement submitted by Power Reactor Development Co. in an open hearing before the Joint Committee on Atomic Energy, March 4, 1958.

On page 1 of that statement, they say:

> The contract (that is, the contract between the AEC and PRDC) further provides for certain research assistance to PRDC by the Commission not to exceed $4,450,000 and for a waiver of use charges for special nuclear material for a period ending 5 years after issuance of a facility license.

Then they go on to say on page 2:

> Since the execution of this contract, PRDC and the contract administration personnel of the Commission have been working closely to implement its provisions:

Then they say, lastly, on page 8, in connection with this contract:

> In addition, PRDC's contract with the Commission, effective January 1, 1957, calls for up to $4,450,000 of research and development work to be performed in Commission facilities.

They state this in connection with their statement of the overall costs of research and development for the PRDC project. All this appears in the statement submitted by PRDC to the Joint Committee, as I say, on March 4, 1958.

We submit that in view of these statements of the parties themselves, representing AEC and PRDC, this money was used just as if that million and a half dollars had been appropriated for the PRDC project.

When AEC comes before you now, they are saying the same thing to you. They say that the total amount for the project is $4,390,000, but all they are asking you for is $2.8 million because they have already received $1.5 million on this project.

I do not know how they could scarcely make it more explicit, Mr. Chairman, that they have used the money that has been appropriated by Congress for carrying out this project.

I say that in the light of the vigorous discussion before the Congress last year as to their right to do this, this is a clear and open and direct and knowing violation of the authorization.

I should like to call your attention to certain portions of that contract itself, indicating to what extent the money applied for this project could not be used for fast breeder projects generally, because a substantial amount of it is directed to the particular project of PRDC. This contract, in appendix A, sets forth the various types of assistance which PRDC is to receive from AEC, and the types are classified in section 2 of that appendix.

Paragraph (a) under that appendix calls for consulting and information services to PRDC. Obviously anything done under that section would not be for the purpose of generally advancing the fast breeder concept.

The second part of that section of paragraph (b) provides for the training of PRDC personnel for operating the PRDC project.

The third part of that section provides for performing a fast reactor critical assembly experiment to provide corroborative information regarding the static nuclear characteristics of the company's reactor. Clearly that is not for the general concept of the fast breeder. It is for the particular breeder which PRDC is building.

Again AEC undertakes to operate two critical assemblies similar to the company's reactor design, to investigate effects of core composition on critical mass, clearly directly related to the PRDC project.

Then again, they are to investigate the Doppler effect measurements in U–235 critical assembly with a neutron spectrum similar to that of the company's design. This question of the Doppler effect is one of the more serious questions involved in this design. AEC is to conduct an experiment directly related to the company's reactor design in regard to this problem.

Then again, it is to conduct 2 or, if agreed, more than 2 critical assemblies to investigate the possibility of supercritical configuration following possible melt-down of the company's reactor.

I could go on, Mr. Chairman; there are other items, showing that it is not possible to carry out this contract as if it did not apply to the company's own reactor alone, and as if it applied to all fast reactors in general.

We submit that it is clear in the light of their own statements, the nature of the contract itself, that they have used the money as if the Congress did appropriate the money for this project.

I think the committee has the resources to get this information with precision and exactitude. They can simply ask the AEC to provide a statement specifically accounting for the ways in which they spent that million and a half dollars.

Under the circumstances, Mr. Chairman, and in view of the fact that this matter is still before the Commission, and the Commission has not yet even issued its tentative decision on our challenge to the validity of its construction permit, the Joint Committee should not approve this authorization. In light of the fact that AEC has a million and a half dollars which it has not—or has an authorization for a million and a half dollars, of which a million dollars apparently is still unspent—no further funds should be authorized to carry out the PRDC project, certainly until and unless the Commission finally rejects our challenge to the validity of the construction permit and the court upholds the action of the Commission.

Representative HOLIFIELD. Does that conclude your statement, Mr. Sigal?

Mr. SIGAL. Yes, sir.

Representative HOLIFIELD. Thank you very much for your testimony before the committee.

The Chair remembers the item, $1,500,000, which is lined out on page 40 of our report of last year, under this wording:

Research and development on fast breeder technology, $1,500,000.

The language referring to it, part of which you read, is as follows:

The committee does not approve the requested authorization for preconstruction research and development work and waiver of fuel-use charges in connection with the reactor project of the Power Reactor Development Co., since legal proceedings before the AEC to determine the probable safety of the proposed reactor is still pending. The committee's attention has been called to sworn testimony given in May and June 1957 by the Chairman and other members of the AEC Advisory Committee on Reactor Safeguards. There is insufficient information available at this time to give assurance that the PRDC reactor can be operated at the Laguna Beach site without public hazard.

However, the committee has voted to make available to the AEC an additional sum of $1,500,000 for research and development in the art of the fast breeder reactor generally, anticipating that this special sum will be expended by AEC in its own laboratories on research and development to gain experience and information.

Your contention is that part of that $1,500,000 has not been spent for the advancement of the art generally, but has been spent in a way which could not be included under the word "general," but for the specific and sole benefit of the PRDC?

Mr. SIGAL. Certainly the specific benefit. Whether anyone else could benefit by it or not, we cannot say.

Representative HOLIFIELD. Any information that is developed in AEC laboratories is available to all industry generally?

Mr. SIGAL. That is right.

Representative HOLIFIELD. Did you make the statement that the AEC is training personnel for the PRDC operation?

Mr. SIGAL. This contract calls for the training of PRDC personnel.

Representative HOLIFIELD. Which contract is that?

Mr. SIGAL. The contract between AEC and PRDC for which this money was originally requested, and which provides for the expenditure of $4,450,000 for research and development pertaining to the PRDC project. It is out of that $4,450,000 that they are now requesting 2.8 million, which is the balance due to make up the 4.450 million, because they had originally spent a couple of hundred thousand dollars in the previous fiscal year. This 2.8 makes up the total of 4.450 million, which they had agreed to spend for research and development on the PRDC project.

Representative HOLIFIELD. I note also in their backup sheet for their request that the Atomic Energy Commission has this language:

Additional requirements for fiscal year 1959 make it necessary to further increase the authorization for appropriations to a new total of $156,072,000 to provide for requirements under the contract with the Power Reactor Development Co., an increase of $2,809,000, and to provide for contracts covering first, second and third generation power reactors under additional proposals expected under the power reactor demonstration program, $20 million.

Your testimony will be considered by the committee and the staff.

At this time, if there is any representative of the PRDC here present and wishes to be heard from, we would be glad to hear.

Mr. McGIFFERT. Mr. Chairman, I am counsel for PRDC. We would like to consider Mr. Sigal's testimony and communicate with you later.

Representative HOLIFIELD. You wish to file a statement?

Mr. McGIFFERT. We would like to consider what he has said and then communicate with the committee.

Representative HOLIFIELD. Will you identify yourself by name?

Mr. McGIFFERT. My name is David McGiffert of the firm of Covington & Burling, Washington, D. C.

Representative HOLIFIELD. The record will be held open for a communication from you.

Mr. McGIFFERT. Thank you.

(Subsequently the Joint Committee, on June 19, 1958, received the following statement from Power Reactor Development Company:)

STATEMENT SUBMITTED BY POWER REACTOR DEVELOPMENT CO.

Power Reactor Development Co., Detroit, Mich. (PRDC) appreciates this opportunity to submit a statement to the Subcommittee on Legislation of the Joint Committee on Atomic Energy. This statement deals primarily with certain questions raised and arguments presented in the testimony of Mr. Benjamin C. Sigal, general counsel of the International Union of Electrical and Machine Workers (AFL–CIO), given to the subcommittee on June 11, 1958. PRDC respectfully requests that this statement be included in the record of the hearings.

In his testimony Mr. Sigal opposes the request of the Atomic Energy Commission for the authorization of additional expenditures on fast reactor research needed to enable it to go forward with the research and development activities in Commission laboratories described in the contract between the Commission and PRDC of March 21, 1957. Mr. Sigal also contends that the research and development work in the fast reactor field already done and contemplated by the Commission under existing authorizing legislation is beyond the authority granted by Congress and therefore unlawful. The burden of this contention appears to be that section 111 (a) (2) of the authorizing legislation of August 21, 1957 (Public Law 85–162), which gave the Commission authority to expend $1,500,000 of appropriated funds "for research and development in Commission laboratories to advance the technology of the fast breeder reactor concept", did not authorize it to do the research and development work described in the PRDC–AEC contract.

First. The extensive legislative history of this provision, which for the most part Mr. Sigal ignores, is squarely to the contrary. This history makes it perfectly clear that Congress intended to authorize the Commission to perform the research and development work in its laboratories which was called for in the PRDC–AEC contract if the Commission in its discretion considered that such work would "advance the technology of the fast breeder reactor concept." In fact, the explanations given by members of the Joint Committee in the debates on the authorizing legislation and in subsequent hearings on the appropriations bill itself make it clear that it was not only intended to authorize the Commission to do this, but that it was generally contemplated that the Commission would in fact take such action.

Under these circumstances, the argument now advanced that what the AEC has done was beyond the scope of its authorization is completely groundless. It appears to be a continuation of the effort on the part of one of the unions which has intervened in the construction permit proceeding before the Atomic Energy Commission to block this project in every possible way.

Section 111 (a) (2) of the 1957 authorization bill as reported by the Joint Committee on Atomic Energy provided:

"Funds in the amount of $1,500,000 may be expended for *additional general* research and development in Commission laboratories to advance the technology of the fast breeder reactor concept." [Emphasis supplied.]

As explained further below, the italicized words were subsequently stricken from the bill as enacted.

The committee report (S. Rept. No. 791, 85th Cong., 1st sess., p. 19) noted that funds were not being authorized for research and development work specifically for this project because of the then status of legal proceedings before

the Commission "to determine the probable safety of the proposed reactor." The report went on to state, however, that "an additional sum of $1,500,000 for research and development in the art of the fast breeder reactor generally," was authorized to be expended by the Commission in its own laboratories "to gain experience and information."

Whether or not this provision was intended to authorize the Commission to perform the fast reactor research and development work called for in the PRDC–AEC contract, all of which was to be done in Commission facilities, was at first not entirely clear. Accordingly, when the bill was considered on the floor of the House there was considerable discussion of this question. This rather lengthy debate is cited in full and extensively quoted in an appendix to this statement. The explanation given by Chairman Durham is both authoritative and a fair sampling of the discussion:

"If you know that project, it got into this shape: We placed a provision in the 1954 act which provided for regulatory powers, and that protest on this PRDC reactor was brought before a hearing examiner under the general law on the basis of safety. It has been down there about a year before the examiner. The committee did not feel that we should go all out and simply name this project and say this $1,500,000 is for the project, but it is the only private project that is being carried on the fast breeder reactor concept. *It is understood by most of the Members that the $1,500,000 can be expended for research and development of benefit to that project, and it should be expended.*" [Emphasis added.] (Congressional Record, Aug. 8, 1957, p. 12853.)[1]

* * * * * * *

Mr. MEADER. * * * Under the language and wording of the bill, as agreed to by the conferees, would the gentleman construe the language to mean that the Atomic Energy Commission can, if it so desires, spend up to $1,500,000 on the [PRDC] fast-breeder reactor at Monroe, Mich.?

"Mr. DURHAM. I think it is in general agreement that the gentleman's statement is correct and it can be used for that purpose" (Congressional Record, Aug. 20, 1957, p. 14040).

The House did not accept the provision recommended by the committee, but adopted an amendment to the bill which specifically named PRDC in connection with the authorization of $1,500,000.

The Senate rejected the House amendment and passed the bill as originally reported, but at the same time made it clear, in the words of Senator Pastore, that "* * * insofar as intent and practicality are concerned, all the money [$1,500,000] can be used in the laboratories for research for the benefit of the Power Reactor Development Co., if it happens to be the only company engaged in that kind of research" (Congressional Record, Aug. 16, 1957, p. 13710).

The conference committee adopted the Senate provision, but in order to remove all possible question about the Commission's authority to do research and development work in aid of the PRDC project, it eliminated the limiting words "additional general" from the language of the Senate bill. The provision as finally enacted thus read:

"Funds in the amount of $1,500,000 may be expended for research and development in Commission laboratories to advance the technology of the fast breeder concept."[2]

In explaining this amendment the managers on the part of the House stated that:

"It was understood that the funds authorized in this subsection might be used for research and development in Commission facilities by the Commission *as it deems desirable* to advance the technology of the fast-breeder-reactor concept." [Emphasis added.] (H. Rept. 1204, 85th Cong., 1st sess.)

The words "additional general" were cut out, as indicated by the following colloquy between Senators Potter, Anderson, and Pastore, so as to make it perfectly clear that the Commission could spend the $1,500,000 on work in Commission laboratories directly or even solely for the PRDC reactor:

"Mr. POTTER. I should like to ask the Senator about subsection 111. I note that the conference report deletes the words 'additional general.' Is it the under-

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[1] Citations to the Congressional Record throughout this statement are to the daily edition.

[2] In his testimony before this subcommittee on June 11, Mr. Sigal ignored this change and incorrectly quoted the provision as enacted as being limited to "additional general" research and development in Commission laboratories. (See typed transcript, pp. 518–519.)

standing of the Senator from New Mexico that the language provided in this section will be ample authorization for the Commission to grant $1,500,000 to the Power Reactor Development Corp., if it so desires?

"Mr. ANDERSON. The problem has been, as the Senator from Michigan recognizes, that there is some controversy over the reactor. *Throughout the discussion it was stated that the $1,500,000 would be available to be spent in the Commission laboratories for projects on a fast breeder that would be directly related to, and perhaps solely for the benefit of, the Power Reactor Development Corp.* I wish to make clear that that is as far as the committee can go. In addition, there is $40 million of other money for fast-breeder technology. But if there were particular problems relating to the project which the Power Reactor Development Corp. is planning to build, there is the $1,500,000 which is allowed for such work in the Commission laboratories, where these projects can be tested and approved.

* * * * * * *

"Mr. PASTORE. Mr. President, will the Senator from New Mexico yield to me?

"Mr. ANDERSON. I yield.

"Mr. PASTORE. *It is a fact, is it not, that if all the research which is to be conducted in the Government laboratories is to be explicitly for the benefit of the power Reactor Development Corp., there will be no violation of the law. I think that straightens out the point.*" [Emphasis added.] (Congressional Record Aug. 20, 1957, p. 13974.)

There can thus be no question about the authority of the Commission under this legislation to expend up to $1,500,000 on fact reactor research and development work in Commission laboratories, which would be of assistance to the PRDC project, whether or not specifically provided for by the terms of the contract. This is further confirmed by authoritative statements made by members of the Joint Committee in connection with the subsequent legislation which actually appropriated the $1,500,000 authorized by section 111 (a) (2) of Public Law 85–162. This testimony also is cited and extensively quoted in the appendix to this statement. The colloquy which occurred in hearings held before the Senate Committee on Appropriations on the Atomic Energy Commission appropriation bill for fiscal year 1958 is particularly revealing:

"Mr. FIELDS. In other words, if we build a mockup or a critical experiment that was really the kind of thing that they [PRDC] would build, but it had to be built in our facilities, in order to get the data for that reactor, this would be in accordance with the authorization in the act that is presently waiting to be signed.

"Senator ANDERSON. In my opinion, it would. As I have many times said, I am not a lawyer; therefore, when it comes to interpreting the law, I can speak very freely. Lawyers are restrained.

"Senator PASTORE. I am a lawyer and I am not getting into the legal aspects of it at this time, but I do want to say that the statement just made by Mr. Anderson is clearly the understanding of all of the Senate members of the Joint Committee on Atomic Energy. Am I right, Senator Hickenlooper?

"Senator HICKENLOOPER. That is correct" (hearings before Senate Committee on Appropriations on H. R. 9379, 85th Cong., 1st sess., pp. 16–17).

One of the research items covered by the PRDC–AEC contract which was particularly singled out for criticism by Mr. Sigal in his testimony before this subcommittee was the very "critical experiment" referred to in this discussion.

A full consideration of the legislative history of the 1957 authorization and appropriation acts thus makes it perfectly clear that there is no substance to the charge that the fast reactor research and development work which has been undertaken by the Commission is beyond its authorization. Existing legislation plainly authorizes the Commission to expend up to $1,500,000 on the type of fast breeder reactor work in Commission laboratories which is covered by the provisions of the PRDC–AEC contract.

Second. If the objection which has been raised is not that the work done by the Commission itself has been unauthorized but that the Commission has improperly concluded that the cost of such work should serve to reduce any obligation under its contract with PRDC, the objection seems ridiculous as well as irrelevant. The work which has been and is being done under section 111 (a) (2) of the 1957 authorization bill is all work which effectively advances the technology of the fast breeder reactor concept, and thus is clearly within the authorization. To the extent that such work also falls within the description of work called for by the PRDC-AEC contract, the Commission has

treated any obligation under that contract as discharged to the extent of the work done. Failure on the part of the Commission to do this would have been more, not less, favorable to PRDC, and might well have resulted in criticism from the Comptroller General as well as from the Congress.

Third. PRDC urges the Joint Committee to approve the additional appropriation authorization for research and development work in this field which has been requested by the Commission and is included in the pending authorization bills, S. 3788 and H. R. 12459. No contribution of any kind is sought to the construction costs of this project. All of the further work requested to be authorized is research and development by the Commission which will serve to advance technology in the field of fast breeder reactors. In view of the admitted importance of this type of reactor and of the substantial progress in this area being made by the British and perhaps other nations, we believe it is plainly in the public interest that this work go forward as expeditiously as possible.

PRDC also respectfully submits that no valid reason exists at the present time for not authorizing this work to be done in terms under the PRDC-AEC contract. The contentions previously advanced that the contract itself is illegal have not been supported by the analysis and review made by the Comptroller General and reported to the Joint Committee on August 9, 1957. The private utility and industrial companies involved have spent or definitely committed well over $50 million on the nuclear portion of the proposed plant and associated research and development work, none of which expenditure is an investment on which any monetary profit can be obtained by any of them and all of which is dedicated exclusively to the advancement of the technology of the fast breeder reactor as a potential source of economic nuclear electric power. See PRDC statement in section 202 hearings, 1958, pp. 528–536. The additional related research and development work to be done by the Commission is relatively small compared with the total amount spent and committed to this undertaking.

While the Commission has not yet handed down a decision in the pending construction permit proceedings, there have been significant developments since this matter was before the Congress last year. The separated staff of the Commission, which participated actively throughout the hearings, has recommended a finding that the probable safety of the reactor has been adequately shown to justify continuation of the construction permit. The State of Michigan in oral argument before the Commission on May 29 similarly agreed that the evidence submitted provides "a reasonable basis for optimism" that the required showing of safety can be made prior to operation. All that is involved at the present time, of course, is authority to continue construction of the reactor—activity which all agree presents no hazard whatever.

Furthermore, the most important of the technical questions which remained unresolved a year ago—the possibility that a fast reactor might have inherent characteristics that render it unstable—has now been laid to rest by subsequent experimental work done on the rebuilt experimental breeder reactor No. 1 at the National Reactor Testing Station in Idaho during the past 9 months.

Approval by the Congress of the Commission's relatively modest appropriation authorization request in this area would in no sense be the taking of a position by the Congress with respect to the issues presented in the contested license proceeding pending before the Commission. On the contrary, refusal of such request would in effect constitute unwarranted criticism and discouragement of an important nonprofit developmental enterprise which has as its sole objective the advancement of the frontiers of knowledge in this critical area. PRDC and its member companies accordingly urge that the Joint Committee recommend the enactment of the Commission's authorization request for further research and development work in this area.

Respectfully,

POWER REACTOR DEVELOPMENT CO.,
By ROBERT W. HARTWELL, *General Manager.*

JUNE 19, 1958.

APPENDIX

LEGISLATIVE HISTORY OF SECTION 111 (a) (2) OF PUBLIC LAW 85-162 AND OF CORRESPONDING APPROPRIATION PROVISION CONTAINED IN PUBLIC LAW 85-175

Introduction.—The legislative history of the authorization and appropriation of $1,500,000 for fast breeder reactor research made by the 85th Congress, 1st session, will be found in the following hearings, reports and debates:

Hearings

Hearings on authorizing legislation before Subcommittee on Legislation of the JCAE (April to July, 1957): pages 146–147, 153, 439–467, 480–485, 547–552, 597–639, 653, 694–695.

Hearings on Atomic Energy appropriations for 1958 before subcommittee of House Committee on Appropriations (July 1957): pages 217, 226–227.

Hearing on Atomic Energy Commission appropriation bill, 1958, before Senate Committee on Appropriations (August 1957): pages 10, 14–20.

Reports

Report of JCAE (H. Rept. 978) on H. R. 8996, 85th Congress, 1st session: pages 19–20, 33, 57–58.

Conference report (H. Rept. 1204) on H. R. 8996, 85th Congress, 1st session: pages 7, 11.

Report of House Committee on Appropriations (H. Rept. 1217) on H. R. 9379, 85th Congress, 1st session: page 2 (see also p. 2 of previous committeee print of this report).

Report of Senate Committee on Appropriations (S. Rept. 1080) on H. R. 9379, 85th Congress, 1st session: page 2.

Conference report (H. Rept. 1242) on H. R. 9379, 85th Congress, 1st session: page 2.

Debates (all citations to the Congressional Record in this appendix are to the daily edition thereof)

Authorizing legislation: Congressional Record, August 1957, pages 12444, A6320–A6321, 12498, A4632, 12853, 12855, 12857, 12858, 12862, 12863, 12978, 12986, 12990, 13703, 13705–13706, 13709–13719, 13722, 13974, 14040, 14041–14042.

Appropriations legislation: Congressional Record, August 1957, pages 14159, 14470.

Set forth below are excerpts from this legislative history.

AUTHORIZING LEGISLATION (PUBLIC LAW 85-162)

1. Section 111 (a) (2) of H. R. 8996 and S. 2674, as reported:

"Funds in the amount of $1,500,000 may be expended for additional general research and development in Commission laboratories to advance the technology of the fast-breeder reactor concept."

2. Report of the Joint Committee on Atomic Energy on H. R. 8996 and S. 2674:

"The committee does not approve the requested authorization for preconstruction research and development work and waiver of fuel-use charges in connection with the reactor project of the Power Reactor Development Co., since legal proceedings before the AEC to determine the probable safety of the proposed reactor are still pending.

"The committee's attention has been called to sworn testimony given in May and June 1957 by the chairman and other members of the AEC Advisory Committee on Reactor Safeguards that there is insufficient information available at this time to give assurance that the PRDC reactor can be operated at the Laguna Beach site without public hazard.

"However, the committee has voted to make available to the AEC an additional sum of $1,500,000 for research and development in the art of the fast-breeder reactor generally, anticipating that this special sum will be expended by AEC in its own laboratories on research and development to gain experience and information" (H. Rept. 978, 85th Cong., 1st sess., pp. 19–20).

3. Statements during debate in House of Representatives on H. R. 8996 as reported:

Representative Durham, chairman of the Joint Committee on Atomic Energy:

"If you know that project, it got into this shape: We placed a provision in the 1954 act which provided for regulatory powers, and that protest on this PRDC reactor was brought before a hearing examiner under the general law on the

basis of safety. It has been down there about a year before the examiner. The committee did not feel that we should go all out and simply name this project and say this $1,500,000 is for the project, but it is the only private project that is being carried on the fast breeder reactor concept. It is understood by most of the members that the $1,500,000 can be expended for research and development of benefit to that project, and it should be expended" (Congressional Record, Aug. 8, 1957, p. 12853).

Representative Van Zandt:

"Insofar as the PRDC project is concerned, others of my colleagues will discuss this subject. I wish to emphasize, however, that it was the intent of the members of the Joint Committee that the $1,500,000 authorized by section 111 (a) (2) could be used by the Commission for work on the PRDC project if the Commission elected to do so" (Congressional Record, Aug. 8, 1957, p. 12855).

Representative Holifield, chairman of Joint Committee on Atomic Energy Subcommittee on Legislation:

"Mr. HOLIFIELD. The committee has put no prohibition upon the Atomic Energy Commission in regard to how the money shall be spent, but it has not specifically authorized it for this contract. I want the record to be very clear that the specific authorization by the Congress of this amount would be considered legally, I suppose, a validation of the contract. The contract is made contingent upon the authorization of congressional funds. The committee has not authorized funds for this specific contract, but funds are available to conduct any type of research and development work which the Commission decides, in its judgment, should be done.

"Mr. MEADER. Then the language which the gentleman has referred to and quoted on page 19 would not prevent the Atomic Energy Commission from going on with research and design, and so forth?

"Mr. HOLIFIELD. In my opinion, and I can speak only as an individual, the Atomic Energy Commission is free to use any of the funds which are available, although it says it does not need the $1,500,000.

"Mr. MEADER. In other words, as I understand the gentleman, notwithstanding the language on page 19 of the report, the Atomic Energy Commission could, if it so desired, use up to $1,500,000 for preconstruction research and development work on the reactor of the Power Reactor Development Co.?

"Mr. HOLIFIELD. This is an administrative decision, which the Atomic Energy Commission will have to make. I am not telling the Atomic Energy Commission to use it for that, and I am not telling it not to use it for that. The committee language states:

" 'The committee does not approve the requested authorization for preconstruction research and development work and waiver of fuel-use charges in connection with the reactor project of the Power Reactor Development Co., since legal proceedings before the AEC to determine the probable safety of the proposed reactor are still pending.'

"Mr. MEADER. In other words, the committee neither approves nor disapproves the use of funds for the purpose mentioned in that paragraph?

"Mr. HOLIFIELD. The language speaks for itself.

"Mr. MEADER. You did not approve, and you did not disapprove" (Congressional Record, Aug. 8, 1957, p. 12863).

Representative Patterson:

"The committee report even indicates that no funds are to be authorized for the Power Reactor Development Co., which is a company sponsored by private utilities and privately owned companies. However, this is not a correct statement of committee intent. On several occasions it was directly stated by leading members of the committee that all of the funds authorized, $1,500,000, could be applied to the Power Reactor Development Co. contract, if the Commission in its discretion, elects to do so" (Congressional Record, Aug. 8, 1957, p. 12858).

4. Section 111 (a) of H. R. 8996 as passed by the House:

"* * * *Provided, however,* that not more than $1,500,000 is authorized for the Power Reactor Development Company project during fiscal year 1958" (Congressional Record, Aug. 9, 1957, p. 12990).

5. Statements during debate in the Senate on S. 2674 as reported:

Senators Anderson and Hickenlooper:

"Mr. ANDERSON. * * * I say that we have provided for the Detroit group all the money the Atomic Energy Commission has asked for this year, and all the money the Bureau of the Budget has approved for this fiscal year. I do not know how we can do otherwise. I know there is an argument about it, but the matter

is in court at the present time, and we do not think we should commit ourselves years into the future.

"We have given them the $1½ million, which was all the Atomic Energy Commission asked for this fiscal year, and all the Bureau of the Budget recommended for this fiscal year. Next year will be another story. I will come to that later on" (Congressional Record, Aug. 16, 1957, p. 13703).

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"Mr. HICKENLOOPER. * * * The Senator from New Mexico [Mr. Anderson] said—and very properly, I think—in answer to a question a short time ago, that that took care of the $1,500,000 for the Public Reactor Development Corp., but, if we read the report, that is not what is said in the report. What it says is diametrically opposed to that. It was my contention in committee that the report did not reflect what the committee almost unanimously, so far as I can recall, agreed should be done. I cannot imagine how that language crept into the report, but it is in there.

"Mr. POTTER. The committee report states:

" 'The committee does not approve the requested authorization for preconstruction research and development work and waiver of fuel-use charges in connection with the reactor project of the Power Reactor Development Co.'

"Mr. HICKENLOOPER. Yes; that is the language to which I was referring. I say that it was the general—and, I think, universal—understanding of the committee that the million and a half dollars could be used for the Power Reactor Development Co., but, for some reason or other, the committee report contains the language the Senator has read.

"Mr. ANDERSON. Mr. President, will the Senator yield?

"Mr. HICKENLOOPER. I yield.

"Mr. ANDERSON. The matter is in litigation. The million and a half dollars will be useful on projects specifically required to complete this reactor so far as research is concerned. Thirty million dollars, in addition, is contained in the bill for the general field including FBR II [sic] which is essential to the PRDC. We thought that we did very well in providing the exact amount approved by the Bureau of the Budget and requested by the Atomic Energy Commission for this year, but it seemed desirable to make it available to be spent by the Commission in its own laboratories. That is what it asked for" (Congressional Record, Aug. 16, 1957, pp. 13706–13707).

Senator Pastore:

"But it is a fact that although the $1,500,000 could not be assigned directly to this contract, the law is written in such a way—and the question which arose at the hearings and the report itself indicate rather clearly—tha this $1,500,000 can be spent for research in Government laboratories, which is all that the contract ever called for, and the research could be for the benefit of the contract of the Power Reactor Development Co., even though it could not be assigned to the contract.

"The reason for that, as I understand, is that the committee did not want to assume the responsibility of doing anything which might be construed as authorizing a contract in connection with which the reactor itself would be suspect because of some safety factor.

"I think that position was prudent and was an exercise of good judgment. I do not think it harms in the least the Power Reactor Development Co.'s program, because that company is the only one which has submitted a proposal for a fast breeder type of reactor. It is the only one which has the benefit of this type of reasearch. For all practical purposes, I think the purpose is being carried out, because the amount allowed by the Bureau of the Budget was $500,000, and the amount asked for by the Commission was $406.000.

"So I say to the distinguished Senator from Michigan that although the pending bill does not satisfy him and cannot satisfy him up to the last letter, yet, insofar as intent and practicality are concerned, all the money can be used in laboratories for research for the benefit of the Power Reactor Development Co., if it happens to be the only company engaged in that kind of research" (Congressional Record, Aug. 16, 1957, p. 13710).

* * * * * * *

"Mr. POTTER. We are discussing the amendment of the Senator from Iowa, which does not provide $4,206,000. It provides $1,500,000.

"Mr. PASTORE. That is already in the agreement. I have already explained to the distinguished Senator from Michigan that all the money can be used for

the benefit of PRDC, and I challenge anyone to dispute that statement" (Congressional Record, Aug. 16, 1957, p. 13711).

6. Section 111 (a) (2) of H. R. 8996 as passed by the Senate:

"Funds in the amount of $1,500,000 may be expended for additional general research and development in Commission laboratories to advance the technology of the fast breeder reactor concept."

7. Conference committee report on H. R. 8996:

"In subsection 111 (a) (2) the conference committee deleted the words 'additional general' from the language in the Senate bill. It was understood that the funds authorized in this subsection might be used for research and development in Commission facilities by the Commission as it deems desirable to advance in the technology of the fast-breeder concept" (H. Rept. 1204, 85th Cong., 1st sess., p. 11).

8. Statements during debate in House of Representatives on the conference committee report:

"Mr. MEADER. As the gentleman knows, the power reactor development company fast-breeder reactor project is located near Monroe, Mich., in my congressional district. The gentleman will recall that an amendment offered by the gentleman from New York [Mr. Cole] on the floor of the House specifically earmarked $1,500,000 for research on that fast-breeder reactor. I have been shown the language in the conference report and the amendment that was agreed to by the conferees. I would like to read one sentence from the conference report and then ask the gentleman's opinion:

"'It was understood that the funds authorized in this subsection might be used for research and development in Commission facilities by the Commission, as it deems desirable to advance the technology of the fast-breeder reactor concept.'

"Under that language and the wording of the bill, as agreed to by the conferees, would the gentleman construe the language to mean that the Atomic Energy Commission can, if it so desires, spend up to $1,500,000 on the fast-breeder reactor at Monroe, Mich.?

"Mr. DURHAM. I think it is in general agreement that the gentleman's statement is correct and it can be used for that purpose.

* * * * * * *

"Mr. COLE. The fourth item of controversy was with respect to the PRDC reactor known as the fast-group reactor about which some question of safety has been raised.

"The Commission asked $1,500,000 to continue research in its own laboratories in connection with the PRDC type. The conferees were hesitant to incorporate in a statute any language which could be construed as an approval by the Congress of this particular type of reactor because of the unresolved questions regarding safety. So we did write into the authorization words as follows:

"'Funds in the amount of $1,500,000 may be expended for research and development in the Commission's laboratories to advance the technology of the fast pressure reactor'—

"And so forth. That makes it perfectly clear that there is an authorization for the Commission to spend $1,500,000 in its own laboratories for research in connection with the fast-pressure [sic] type. If the Commission determines that its studies shall be in connection with the PRDC contract the Commission could within its authority spend the fund for that purpose" (Congressional Record, Aug. 20, 1957, pp. 14040–14041).

9. Statements during debate in the Senate on the conference committee report:

"Mr. POTTER. I should like to ask the Senator about subsection 111. I note that the conference report deletes the words 'additional general.' Is it the understanding of the Senator from New Mexico that the language provided in this section will be ample authorization for the Commission to grant $1,500,000 to the Power Reactor Development Corp., if it so desires?

"Mr. ANDERSON. The problem has been, as the Senator from Michigan recognizes, that there is some controversy over the reactor. Throughout the discussion it was stated that the $1,500,000 would be available to be spent in the Commission laboratories for projects on a fast-breeder reactor that would be directly related to, and perhaps solely for the benefit of, the Power Reactor Development Corp. I wish to make clear that that is as far as the Committee can go. In addition, there is $40 million of other money for fast-breeder technology. But if there were particular problems relating to the project which the

Power Reactor Development Corp. is planning to build, there is the $1,500,000 which is allowed for such work in the Commission laboratories, where these projects can be tested and approved.

"Mr. POTTER. Is the Senator from New Mexico saying that the Commission could not grant the $1,500,000 to the Power Reactor Development Corp. for research and development on the fast-breeder reactor?

"Mr. ANDERSON. The work must be done in the Commission laboratories. That is the language, and that is what would have to be done.

"I only say that if they have problems which they are trying to solve, the amount granted to them is not only identical with that originally proposed, but is identical in the way it is to be handled—as was covered by the Bureau of the Budget request. It is for this fiscal year only, and therefore it can be used in case there arises a problem which the officials of the Detroit Electric and the other companies want solved. They will bring that problem to the Atomic Energy Commission, in order to have the Commission help them on their way with the fast-breeder reactor. The Atomic Energy Commission can spend $1,500,000 in its laboratories for the purpose of trying to solve these problems. I believe every member of the committee understood what we tried to do, and I believe the Atomic Energy Commission will be able to do it without any trouble.

"Mr. PASTORE. Mr. President, will the Senator from New Mexico yield to me?

"Mr. ANDERSON. I yield.

"Mr. PASTORE. It is a fact, is it not, that if all the research which is to be conducted in the Government laboratories is to be explicitly for the benefit of the Power Reactor Development Corp., there will be no violation of the law. I think that straightens out the point.

"The PRESIDING OFFICER. The question is on agreeing to the conference report.

"The report was agreed to" (Congressional Record, August 20, 1957, p. 13974).

10. Section 111 (a) (2) as enacted (Public Law 85–162):

"Funds in the amount of $1,500,000 may be expended for research and development in Commission laboratories to advance the technology of the technology of the fast breeder reactor concept."

APPROPRIATIONS LEGISLATION (PUBLIC LAW 85–175)

1. Report of House Committee on Appropriations on H. R. 9379:

"The additional $1,500,000 requested for the fast breeder reactor research has been disallowed. Of the $13,600,000 in the bill for the fast breeder reactor technology, up to $1,500,000 may be used on the decision of the Atomic Energy Commission for the purposes set forth in section 111 (a) (2) of H. R. 8996, 85th Congress."[1] (H. Rept. 1217, 85th Cong., 1st sess., p. 2).

2. Statements during debate in House of Representatives on H. R. 9379 as reported:

"Mr. RABAUT. * * * If you have the report of the committee before you, you will see there is some changed language in the report.

"The committee has made one change in the committee print of the report. On page 2, under the heading 'Reactor Development Program', it has stricken the first sentence and has inserted the following:

" 'The additional $1,500,000 requested for the fast breeder reactor research has been disallowed. Of the $13,600,000 in the bill for the fast breeder technology, up to $1,500,000 may be used on decision of the Atomic Energy Commission for the purpose set forth in section 111 (a) (2) of H. R. 8996, 85th Congress.'

"The purpose of this change is to make it possible for the AEC to conduct research which is applicable to the development of a large-scale fast breeder reactor.

"Such a reactor is presently under construction by the Power Reactor Development Co. at Monroe, Mich. The AEC has a contract with this company to provide certain research. The $1,500,000 requested in the budget estimate was for financing such research in AEC laboratories to be charged against the contract commitment.

"The action that the committee has taken provides for the same amount of money for research, the cost of which is not charged against the contract commitment. In other words, the Congress is not endorsing or implying approval

[1] This language was in substitution of a sentence in the committee print of the report which stated: "The funds requested for the Power Reactor Development Co. project have been disallowed."

of the existing contract with the Power Reactor Development Co." (Congressional Record, August 21, 1957, p. 14159).

3. Excerpts from hearings of Senate Committee on Appropriations, 85th Congress, 1st session, on AEC appropriations:

"Senator ANDERSON. How are you trying to get around the language put in by the Senate and the House—by again stating that this is going to be used to fulfill a contract to the power reactor? You should ask for a million and a half dollars to do what the Congress asked you to do.

"Mr. STRAUSS. We were fearful that to use it under those circumstances for the Power Reactor Development Co. might be considered as an evasion.

"Senator ANDERSON. We have said as clearly as we could on the floor, and I tried to, in answer to a question by Senator Potter and Senator Pastore, as follows—and I assume you have read the legislative history on it—that if Power Reactor Development Co. came in and said, 'We have some problems we would like to have solved specifically for the reactor we are building,' you could take a million and a half dollars for those projects. Do you have to have it said that it is in compliance with the contract?

"Mr. STRAUSS. We understand that the report of the Appropriations Committee specifically struck it.

"Let me give you the language.

"Senator ANDERSON. As far as I am concerned, I would hope that we lived up exactly to what was said on the Senate floor and also was said many times in the hearing; namely, that we do not want the $1,500,000 to get in such shape so that it will lead to confusion and stand like a breach of promise that has been made. A million and a half dollalrs is to be spent, as I understand the bill, for research on the fast breeder reactors in the laboratories of the Atomic Energy Commission. It can be done, as I understand it, and I will not attempt to bind anybody but myself for that, for specific things desired by and essential to the progress of the specific reactor being built by PRDC. I do not believe there exists any bar to that."

* * * * * * *

"Senator PASTORE. * * * It was my understanding that this $1.5 million could legally be used by the Commission in developing the art in its own laboratories which might turn out to be exclusively for the benefit of PRDC but was not dedicating it directly to the contract.

"Senator ANDERSON. Any money put in with reference to the contract would be subject promptly to a point of order. I do not think we need to worry about that. The clear wording of the conference report is 'funds in the amount of $1.5 million may be expended for research and development in the Commission laboratories to advance the technology of the fast breeder reactor concept.'

"If you want that and that the House committee cut it out, I would be most anxious to help you get it back. I would be understanding when I did it that the PRDC would come to you saying that they have specific problems that are almost directly and almost exclusively—in fact, you might be able to say almost exclusively—related to it, so we want to have this work done for us. We want these things done and we wish you would contract up to $1.5 million. If you did it and did it solely for them and did it at their request, and did it in a way that it would be exclusively for their benefit at the time, even though eventually it would be for the general good of everyone, then I would say you had complied with the law completely.

"Mr. FIELDS. In other words, if we build a mock-up or a critical experiment that was really the kind of thing that they would build, but it had to be built in our facilities in order to get the data for that reactor, this would be in accordance with the authorization in the act that is presently waiting to be signed.

"Senator ANDERSON. In my opinion, it would. As I have many times said, I am not a lawyer; therefore, when it comes to interpreting the law, I can speak very freely. Lawyers are restrained.

"Senator PASTORE. I am a lawyer and I am not getting into the legal aspects of it at this time, but I do want to say that the statement just made by Mr. Anderson is clearly the understanding of all the Senate Members of the Joint Committee on Atomic Energy. Am I right, Senator Hickenlooper?

"Senator HICKENLOOPER. That is correct."

(Hearings on Atomic Energy Commission appropriation bill, 1958, before Senate Committee on Appropriations, 85th Cong., 1st sess., pp. 16–17).

4. Senate Committee on Appropriations report on H. R. 9379:

"The committee recommends restoration of $1,500,000 for the reactor development program, to be expended for research and development in Commission laboratories to advance the technology of the fast breeder concept." (S. Rept. 1080, 85th Cong., 1st sess., p. 2).

5. Conference committee report on H. R. 9379:

"Amendment No. 3: Appropriates $2,215,470,000 as proposed by the Senate instead of $2,196,556,000 as proposed by the House. The conferees on the part of both the House and the Senate are in agreement that the purpose of the $1,500,000 provided for advancement of the technology of the fast breeder concept is to make it possible for the Atomic Energy Commission to conduct research which is applicable to the development of a large-scale fast breeder reactor. Such a reactor is presently under construction by the Power Reactor Development Co., at Monroe, Mich. The Atomic Energy Commission has a contract with this company to provide certain research. The $1,500,000 requested in the budget estimate was for financing such research in Atomic Energy Commission laboratories to be charged against the contract commitment.

"The action that the conferees have taken provides for the same amount of money for research, the cost of which is not charged against the contract commitment. In other words, the conferees are not endorsing or implying approval of the existing contract with the Power Reactor Development Co."

6. The conference committee report just quoted was agreed to on August 23, 1957, by the Senate (Congressional Record, p. 14398) and the House (Congressional Record, p. 14470).

Representative HOLIFIELD. Dr. Libby, do you have anything to say?

Dr. LIBBY. We understand, sir, that you had various items that you wanted to bring up on the overall authorization bill and we are here with staff to do this.

Representative HOLIFIELD. It seems there was a little testimony on the $210,000 item for the transportation subsidy for the buslines. Would you like to add to your testimony on that?

Dr. LIBBY. Is there anything, Mr. Derry, you think we ought to add to what was submitted.

STATEMENT OF JOHN A. DERRY, DIRECTOR, DIVISION OF CONSTRUCTION AND SUPPLY, ATOMIC ENERGY COMMISSION

Mr. DERRY. Mr. Chairman, I am Director of the Division of Construction and Supply.

Last year you authorized $75,000. This request is for an increase of $135,000, bringing the total to $210,000, which is our estimated requirements through fiscal year 1959 for the home-to-work contract bus operation.

We feel that the authorization that the committee gave the Commission last year was a major factor in holding the personnel, in convincing the personnel in the Commission to stay with the Commission, and in providing the lower salaried personnel with a means to get to work during the transitional period by either relocation or by arranging car pools. It has proved very satisfactory.

Representative HOLIFIELD. What is the rate of decrease of your transportation load?

How many of these people have found their own means of transportation or moved closer to the Germantown facility?

Mr. DERRY. The transportation load dropped off from a start of something like 350 riders to a present total of around 235 to 250. We expect the load of about 235 to continue through the summer months and up to the time we move the people that are still downtown in Washington in the H Street building. There are still 240

people there. Of these, 160 people have indicated that they need some help in transportation.

These people, in moving out to the building when we complete wing G in the latter part of this year, will increase the load of 235 to probably 350 to 400. Not all of these 160, from our experience, may require transportation, but a large portion of them probably will.

Representative HOLFIELD. So you will be faced, at the end of the year, with more demand than you had at the beginning?

Mr. DERRY. This is possible; yes, sir.

Our experience with the operation of the contract bus system, with the subsidized bus system, from January to the present time, is that we were able to stretch our money out, so to speak, so that we could provide adequate and reliable transportation for all of the people that indicated a need for it, by consolidating routes and terminating contracts and husbanding our resources, so to speak.

We started out with 16 lines, and we are down to 10 right now.

Representative HOLIFIELD. Would you say as far as you can see, this is going to be a permanent arrangement?

Mr. DERRY. No, sir; we do not propose to continue this beyond the present request for authorization, fiscal year 1959. We think that this should be enough to provide the important transitional break for the Commission.

I think the backup statement that we submitted indicated that there might be a need for 18 months. This increased authorization is for fiscal year 1959 only, and as I recall, last month when I was up here with General Fields, there was some indication from the Chair that you asked us whether or not this would continue beyond 1959, and the general manager said that he would take a good hard look at it.

We do not contemplate, at present continuing beyond fiscal year 1959.

Representative HOLIFIELD. That is all, Mr. Derry, thank you.

Mr. RAMEY. There is one question on the reactor program.

We asked for a projection of the monetary level of the program over a 5-year period. It is my understanding that the Commission is preparing such a statement, but that they do not necessarily have that available.

Mr. DAVIS. The situation is that we are working on it, but we have not had a chance to get it all together as yet.

(The Commission indicated, and the committee concurred, that it would not be possible to prepare such an estimate under current circumstances.)

Representative HOILFIELD. In our seminar with the representatives of the equipment manufacturers under date of November 22, 1957, some of the major points covered include point number two, which was headed "Desirability of Fixed Price Contracts," and the following paragraph is underneath it:

> There was virtually unanimous agreement that the concept of fixed-price contracts for research and development work is unworkable and undesirable. It was pointed out that research and development necessarily implies a high degree of uncertainty in the initial cost estimates and that it is not reasonable to expect a manufacturer to absorb the entire difference between original estimates and final costs, particularly where such differences may range up to 100 percent or more. It was suggested that cost-type contracts were more suitable for the construction for first generation prototype nuclear powerplants which involved considerable research and development costs.

It was also felt by some that the buying-in concept by which the manufacturer contributes a portion of the funds for a powerplant project was not desirable as it limited manufacturer participation to those companies with large financial resources.

Has the Commission considered that point, and if so, is there any comment you would like to make on it?

Mr. LIBBY. We certainly have in mind at all times this general problem. The question of support of research and development and the proper way to fund and administer it is broader than just to atomic power.

It is difficult to know what any given piece of research is going to cost. This is certainly true. I think, however, in the power field, it is a little more possible than it is in physical research, biology or some of these fields which are more basic in their approach, shall we say. So, in atomic power, we are sort of intermediate between basic research and pure engineering development work, and we have a better chance of setting some kind of an estimate which will be reasonable. But it certainly is a difficult job.

I would like to ask Mr. Davis if he has anything to add to the answer to the question. It is certainly an estimate and a guess in each of these contracts.

Mr. DAVIS. I think we should point out that in the power field, with respect to research and development, these are generally cost-type contracts, but with a ceiling.

Entering into these arrangements, we have tried to establish a ceiling beyond which we would not expect the cost to go. The cost itself up to this ceiling are cost-type contracts. But we have not felt that we should enter into contracts which simply had no ceiling on them whatsoever. It is very difficult to contract for something without some upper limit of cost.

Mr. RAMEY. Sometimes manufacturers complain that is worse because they do not get the advantage of savings if they go below the ceiling, and if they go beyond the ceiling, then they are operating at a very definite loss.

Mr. DAVIS. This is dependent on where the ceiling is set. Fairly obviously, they cannot have it both ways.

Representative HOLIFIELD. I understand the problem you are faced with in this field, and I can understand you trying to set an upper limit, but it does present a real problem. Has it been impossible for you to gage a project by the progress you make on an annual basis and relinquish the funds in that manner on an annual basis, according to the progress made?

Mr. DAVIS. It would be very difficult to do it on an annual basis and still have a commitment to build a reactor. You cannot have it completely open ended on one side and then say there must be a commitment to build a reactor on the other side. You have to set down in the contract what the terms are and one of the terms has got to be some fixed amount of money.

Representative HOLIFIELD. The commitment of the Government on the research and development side?

Mr. DAVIS. Yes, sir.

Representative HOLIFIELD. What about the "buying in" factor?

There has been some complaint there that the large companies that have large resources can afford to contribute $1 million or $5 million

toward a project in order to get in on the project, and then, through the tax laws, they write this amount off as an operating expense, in essence, and therefore it gives them an advantage which a smaller company does not have.

Mr. DAVIS. I believe we discussed this the other day.

I think there have certainly been in all probability some instances where the companies were perhaps gambling that they would have a loss and maybe even somewhere they deliberately assume that they would. I think that the cases where prices and costs having gone up have been more largely due simply to poor estimates to start with than they have been due to the fact that they were willing to accept the difference at the start as a loss.

Representative HOLIFIELD. That does not pertain to the buy-in contribution?

Mr. DAVIS. What I am saying, Mr. Holifield, I do not think there have been really too many cases where they have been trying to buy in in this respect. Sometimes they may.

Representative HOLIFIELD. They call it a contribution, such as the $5 million of Consumers and Duquesne, who both contributed, as I remember, something like $5 million.

Mr. DAVIS. I thought that was a different kind of thing where they simply agreed to make an out-and-out contribution as a part of the project in a fixed amount. I thought you were referring to people coming in and making fixed-price contracts with the expectation of losing money when they carried out the contracts.

Mr. RAMEY. In several cases they have termed those contributions that they expected to do it at cost or that they did not put overhead into their estimate and no profit, and that the difference between that fixed amount and what their normal overhead and profit would have been is their contribution.

As a matter of fact, the Commission, in a number of its criteria, said that they take into account the contribution made by the other party.

Mr. DAVIS. I am here trying to distinguish between cases where someone has said, "We will put $5 million into this as our contribution toward carrying out this project," and what I would regard as a different case, where someone comes up with a bid for a particular plan and says, "This is the price at which we will do it," but without telling us, in effect, that they are planning to do it even if it costs them a million or 2 million more than their bid.

There certainly are cases where people have offered to share costs. I felt you were speaking mainly about the case where someone either intentionally, or perhaps after he had gone some ways, finds he is unintentionally making a contribution which was not spelled out at the start of the arrangement.

Representative HOLIFIELD. Such as the Army package reactor at Belvoir?

Mr. DAVIS. In that case they started with a perfectly straightforward estimate that this would be the cost and they wound up with costs which exceeded the contract price by some amount.

Mr. RAMEY. In that case, the Commission's estimate indicated that they would be doing it at a loss, did it not?

Mr. DAVIS. The Commission estimate was also higher than what it actually cost them. Their actual costs of building the job were under all of the bids that were received.

So if one had accepted the higher bids, you would have paid more than the job actually cost, or even more than it cost them.

Mr. RAMEY. But their costs were more than the contract price?

Mr. DAVIS. Their costs were more than the contract price, but their costs were less than most of the bids that were received for the job.

Representative HOLIFIELD. There must be some resolution of this request for moneys on the so-called PRDC contract.

I find your back-up material in contradiction to the position taken in this report. I would suggest that the AEC review its back-up material on that, and also the testimony of Mr. Sigal today, and be prepared to give us a statement on that matter.

Mr. LIBBY. We will so do.

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., June 20, 1958.

Hon. CHET HOLIFIELD,
House of Representatives.

DEAR MR. HOLIFIELD: At the hearings before the Subcommittee on Legislation of the Joint Committee on Atomic Energy on June 11, 1958, you requested the Commission to advise you regarding the basis for the utilization of funds, authorized to be appropriated to the Atomic Energy Commission under section 111 (a) (2) of Public Law 85–162 and appropriated under Public Law 85–175, for work to be performed in Commission facilities in connection with the Power Reactor Development Co. fast breeder reactor project. This letter is in response to that request.

Under section 111 (a) of Public Law 162, there are authorized to be appropriated to the Commission specified amounts, subject to a number of conditions, including the following:

"* * * (2) Funds in the amount of $1,500,000 may be expended for research and development in Commission laboratories to advance the technology of the fast breeder reactor concept."

Public Law 85–175 imposes no pertinent restrictions. We can assure you that the $1,500,000 presently being utilized for research and development in connection with the PRDC project will contribute significantly to the technology of the fast breeder reactor concept.

Before appropriations authorized in accordance with section 111 (a) (2) were expended, a careful analysis of the legislative history of this provision was made. At that time we concluded that the utilization of the funds for work in connection with the PRDC project was clearly consistent with expressions of congressional intent set forth in many hearings, reports and debates. Some of the statements relied on are contained in the attachment to this letter. We have now reviewed our former conclusion and believe that it was entirely correct.

In the Commission's current request for authorization of appropriations, the sum of $2,809,000 is stated to be required under the contract with PRDC. The reduction from the amount requested last year reflects the amount of work that is being done in AEC laboratories pursuant to the provisions of section 111 (a) (2). Funds expended for this work have not been obligated under the PRDC contract. Nevertheless, the work that has been done has relieved the Commission from fulfilling a portion of its contractual commitments; to this extent a reduction may be made in the amount of funds required for completion of the work contemplated by the contract.

If we can be of further assistance to you in this matter, please do not hesitate to call upon us.

Sincerely yours,

K. E. FIELDS, *General Manager.*

AUTHORITY TO USE FUNDS AUTHORIZED BY SECTION 111 (a) (2), PUBLIC LAW 85–162 IN CONNECTION WITH PRDC PROJECT—EXCERPTS FROM LEGISLATIVE HISTORY

In the Senate debates on the authorization bill Senator Pastore on August 16, 1957, at page 13710 of the Congressional Record, had this to say:

"Mr. PASTORE. I agree with the sentiments expressed by the Senator from Michigan. But it is a fact that, although the $1,500,000 could not be assigned directly to this contract, the law is written in such a way—and the question which arose at the hearings and the report itself indicate rather clearly—that this $1,500,000 can be spent for research in Government laboratories—which is all that the contract ever called for—and the research could be for the benefit of the contract of the Power Reactor Development Co., even though it could not be assigned to the contract.

"The reason for that, as I understand, is that the committee did not want to assume the responsibility of doing anything which might be construed as authorizing a contract in connection with which the reactor itself would be suspect because of some safety factor.

"So I say to the distinguished Senator from Michigan that, although the pending bill does not satisfy him and cannot satisfy him up to the last letter, yet, insofar as intent and practicality are concerned, all the money can be used in laboratories for research for the benefit of the Power Reactor Development Co., if it happens to be the only company engaged in that kind of research."

On August 20, 1957, in the House during a colloquy between Mr. Meader and Mr. Durham on the authorization bill, the following question and answer are of importance (Congressional Record, August 20, 1957, pp. 14040–14042):

"Mr. MEADER. Under that language and the wording of the bill, as agreed to by the conferees, would the gentleman construe the language to mean that the Atomic Energy Commission can, if it so desires, spend up to $1,500,000 on the fast-breeder reactor at Monroe, Mich.?

"Mr. DURHAM. I think it is in general agreement that the gentleman's statement is correct and it can be used for that purpose."

Later Mr. Cole commented:

"Mr. COLE. The fourth item of controversy was with respect to the PRDC reactor known as the fast-group reactor about which some question of safety has been raised.

"The Commission asked $1,500,000 to continue research in its own laboratories in connection with the PRDC type. The conferees were hesitant to incorporate in a statute any language which could be construed as an approval by the Congress of this particular type of reactor because of the unresolved questions regarding safety. So we did write into the authorization words as follows:

" 'Funds in the amount of $1,500,000 may be expended for research and development in the Commission's laboratories to advance the technology of the fast-pressure reactor—'

"And so forth. That makes it perfectly clear that there is an authorization for the Commission to spend $1,500,000 in its own laboratories for research in connection with the fast-pressure type. If the Commission determines that its studies shall be in connection with the PRDC contract, the Commission could within its authority spend the fund for that purpose."

On August 21, 1957, during the Senate hearings on the AEC appropriation bill (pp. 15–17), Senator Pastore stated:

"Senator PASTORE. It was my understanding that this $1.5 million could legally be used by the Commission in developing the art in its own laboratories which might turn out to be exclusively for the benefit of PRDC but was not dedicating it directly to the contract."

During the same hearings Senator Anderson had this to say with respect to the specific reference to the PRDC contract:

"Senator ANDERSON. Any money put in with reference to the contract would be subject promptly to a point of order. I do not think we need to worry about that. The clear wording of the conference report is: '* * * funds in the amount of $1.5 million may be expended for research and development in the Commission laboratories to advance the technology of the fast-breeder-reactor concept.'

"If you want that and the House committee cut it out, I would be most anxious to help you get it back. I would be understanding when I did it that the PRDC would come to you saying that they have specific problems that are almost directly and almost exclusively—in fact, you might be able to say almost exclu-

sively—related to it, so we want to have this work done for us. We want these things done and we wish you would contract up to $1.5 million. If you did it and did it solely for them and did it at their request, and did it in a way that it would be exclusively for their benefit at the time, even though eventually it would be for the general good of everyone, then I would say you had complied with the law completely.

"Mr. FIELDS. In other words, if we build a mockup or a critical experiment that was really the kind of thing that they would build, but it had to be built in our facilities in order to get the data for that reactor, this would be in accordance with the authorization in the act that is presently waiting to be signed.

"Senator ANDERSON. In my opinion, it would. As I have many times said, I am not a lawyer; therefore, when it comes to interpreting the law, I can speak very freely. Lawyers are restrained.

"Senator PASTORE. I am a lawyer and I am not getting into the legal aspects of it at this time, but I do want to say that the statement just made by Mr. Anderson is clearly the understanding of all of the Senate members of the Joint Committee on Atomic Energy. Am I right, Senator Hickenlooper?

"Senator HICKENLOOPER. That is correct."

Representative HOLIFIELD. Are there any further questions?

We have no further hearings scheduled, but we will have to digest the testimony, and there may be some points that we will want to bring up outside of those mentioned.

We will accept for the record at this time a letter from the Martin Co., to the director of the staff of the Atomic Energy Committee, signed by the manager, also a statement from the Chamber of Commerce of the United States.

There is also certain back-up material for the files.

THE MARTIN CO.,
Baltimore, Md., June 10, 1958.

Mr. J. T. RAMEY,
Executive Director, Joint Committee on Atomic Energy,
Capitol Building, Washington, D. C.

DEAR MR. RAMEY: Due to the late hour last night, I was not able to get official approval from our management to testify before the Joint Committee today. However, as we are so deeply interested in the problem involved in developing, selling and constructing process heat reactors, we are sending you the enclosed material which will provide you with the basic technical data on the process heat reactor we have designed.

This reactor has been designed for the utmost economy. It achieves low operating costs through low pressure and low temperature operation. We estimate that at a United States location this reactor, with a rated capacity of 150,000 pounds of steam per hour, can produce steam at a cost of 79 cents per thousand pounds of steam. This figure assumes no AEC aid.

We are offering this reactor, in cooperation with the architect-engineering firm of H. K. Ferguson Co. who act as the prime contractors, at a fixed price of $2,500,000. In addition, we are prepared to warranty the system by guaranteeing operation at rated capacity during an acceptance check and by guaranteeing certain minimum core life.

If there is a chance that the hearings may be reopened at a later date, we would like to have the opportunity for preparing a statement for presentation to the Joint Committee. Meanwhile, if you have any specific questions about our reactor, we will be very pleased to answer them on an informal basis.

Very truly yours,

J. U. MOWLL,
Manager, Commercial Sales, Nuclear Division.

Budget estimate for a process steam reactor

OPERATING COSTS

Core fabrication and fuel costs:		
Core fabrication, labor and material		$167,350
Fuel costs incurred up to core delivery:		
Processing UF_6 to UO_2	$76,390	
Processing loss, UF_6 to UO_2	13,345	
Chemical analysis	1,050	
Reprocessing pellet rejects	56,240	
Lease charges	22,000	
		169,025
		336,375
Refueling cost per year: 3 nuclear specialists for 2 weeks plus allowance for amortizing cask		15,000
Core-reprocessing costs:		
Burn up	$219,780	
Reprocessing spent fuel	126,200	
Reprocessing losses	7,130	
Pu recovery charge	34,000	
Lease charges while in operator's possession	40,000	
		472,110
Fuel credit less Pu credit at $30 per gram		270,000
Net fuel reprocessing cost		157,110
Total cost of fuel		508,485
Depreciation (5 percent)		125,000
Insurance: 35 percent on 75 percent		6,600
Nuclear insurance estimate [1]		40,000
Taxes $60 per $1,000 on 25 percent		37,500
Labor, 8 men at $6,000		48,000
Social security		2,500
Sick leave, vacations		20,000
Supplies and maintenance		50,000
Total		838,085

[1] Based on $6,000,000 nuclear liability insurance. If $60,000,000 of liability insurance is required by AEC, annual cost will be $100,000.

NOTE.—150,000 pounds of steam per hour by 8,000 hours per year equals 1,200,000,000 pounds steam per year. 838,085 divided by 1,200,000 equals 70 cents per 1,000 pounds of steam.

CAPITAL COSTS

Martin design engineering—fabrication of core components and test operation	$450,000
Purchase and installation of primary loop equipment	1,090,000
Purchase and installation of piping and valves and auxiliary equipment	285,000
Subtotal	1,825,000
Containment structure including pit for reactor	440,000
Control building	20,000
Water-storage tanks	15,000
Subtotal	2,300,000
Design contingency	200,000
Total budget cost estimate	2,500,000

CHAMBER OF COMMERCE OF THE UNITED STATES,
Washington, D. C., June 4, 1958.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Legislation of the Joint Committee on Atomic Energy, House Office Building, Washington, D. C.

DEAR MR. HOLIFIELD: The Chamber of Commerce of the United States approves the principle contained in section 110 of S. 3788 and H. R. 12459, which affords private enterprise the opportunity of building and operating power reactors by making project 59–d–10, a 40,000-kilowatt gas-cooled power reactor, available to industry under a cooperative program with the Atomic Energy Commission if this project is considered the best way to prosecute the program. We also endorse the basis for the cooperative agreement which will be that "the Commission will contribute to the cost of research and development * * * not including, however, any contribution of funds to be employed in the construction or operation of the reactor."

Such a cooperative agreement under which industry will be given the opportunity to build and operate the reactor as the great advantages of bringing industry's resources, know-how, and experience into the atomic power program and, at the same time, saving considerable amounts of the taxpayers' money. We strongly urge that in all power reactors generating electric power, industry be afforded the opportunity of undertaking construction and operation and that United States leadership in developing atomic power for the benefit of mankind should be measured in terms of broad and varied technological progress and applications rather than installed atomic generating capability.

American industry is justified in its pride of the contributions to nuclear power it has made in the 4 short years since Congress permitted industry to own and operate nuclear powerplants. By the end of this year the Atomic Energy Commission estimates private industry's investment in nuclear power will exceed $500 million. This is a huge contribution in light of the short span of time and the fact that economic power is still far away.

This contribution has been expanding rapidly and will continue to do so as long as the program is in accord with the principle stated in the Atomic Energy Act of 1954, that "the development, use, and control of atomic energy shall be directed so as to * * * strengthen free competition in private enterprise."

Any attempt to authorize Government atomic powerplants that produce electricity, without affording industry a prior opportunity to build and operate them, under cooperative agreements or otherwise, would have the following negative effects:

1. Industry would be discouraged from making further contributions to nuclear power.

2. Government ownership has the disadvantage that basic technical decisions will be made by a small group on a noncompetitive basis. Such decisions are always better made when a part of our competitive private enterprise system.

3. The detailed, expensive, and time-consuming supervision of the work involved can best be done by industry.

4. Government ownership would entail unnecessary heavy outlays of tax funds which can be minimized by private ownership and operation.

5. Many scientific and technical personnel of private industry have contributed much to reactor design, development, and operation. Government ownership of power facilities would discourage private industry from further employment of these skilled persons in the nuclear power field. Therefore, the greatest benefit to the public, at the least cost, can be accomplished by a continuation of the present Government-industry cooperation in the power-reactor field with industry building, operating, and distributing the power of such facilities.

I would appreciate it if you would make this a part of your current hearings.

Cordially yours,

CLARENCE R. MILES.

Representative HOLIFIELD. The subcommittee is adjourned.

(Thereupon, at 3:45 p. m., Wednesday, June 11, 1958, the subcommittee adjourned.)

APPENDIX

Appendix 1

United States Atomic Energy Commission Analysis of Proposed Amendments to Public Law 85–162 (H. R. 12458 and S. 3787)

1. Amendment of subsection (a) to section 111, Public Law 85–162
2. Addition of subsection (c) to section 111, Public Law 85–162
3. Addition of subsection (d) to section 111, Public Law 85–162
4. Addition of subsection (e) to section 111, Public Law 85–162

AMENDMENT TO SECTION 111 (A) OF PUBLIC LAW 85–162

Public Law 85–162 authorized appropriations in the amount of $129,915,000 for a cooperative power reactor demonstration program. Based on program developments involving new proposals and changes in proposals before the Commission when Public Law 85–162 was enacted, authorization for appropriation is now required in the amount of $133,863,000. The following table sets forth a comparison between the proposals which formed the basis for the amount previously authorized and present Commission plans with respect to the cooperative power reactor demonstration program:

[In thousands]

	Previous estimate	Revised estimate for 1958
First round:		
Consumers:		
Preconstruction research and development	$18,165	$18,165
Unusual maintenance and fuel cycle costs	8,000	8,000
Construction	24,013	24,013
Total consumers	50,178	50,178
Fast breeder research and development	1,500	1,500
Total, first round	51,678	51,678
Second round:		
Elk River:		
Preconstruction research and development	2,760	0
Construction	5,686	9,269
Total, Elk River	8,446	9,269
Wolverine:		
Preconstruction research and development	1,635	0
Construction	3,837	0
Total, Wolverine	5,472	
Piqua:		
Preconstruction research and development	3,500	3,500
Construction	4,010	5,487
Total, Piqua	7,510	8,987
Chugach:		
Preconstruction research and development	9,080	8,155
Construction	6,729	9,229
Total, Chugach	15,809	17,384
Postconstruction research and development:		
Piqua		3,318
Elk River		2,176
Chugach		2,500
Wolverine		0
Total, postconstruction research and development	11,000	7,994
Total, second round	48,237	43,634

[In thousands]

	Previous estimate	Revised estimate for 1958
Third round:		
Northern States:		
Preconstruction research and development		$5,500
Postconstruction research and development		500
Total, Northern States		6,000
Carolinas-Virginia:		
Preconstruction research and development		10,145
Postconstruction research and development		3,760
Total, Carolinas-Virginia		13,905
East Central Nuclear Group-Florida West Coast Nuclear Group:		
Preconstruction research and development		8,646
Postconstruction research and development		3,000
tal, East Central Nuclear Group-Florida West Coast Nuclear roup		11,646
Total, third round	$30,000	31,551
Pennsylvania Power & Light:		
Preconstruction research and development (phase I)		7,000
Preconstruction research and development (phase II) [1]		0
Postconstruction research and development (phase II) [1]		0
Total, Pennsylvania Power & Light		7,000
Grand total	129,915	133,863

[1] Authorization to be requested in a subsequent year.

In addition to the amount authorized for appropriation, Public Law 85–162 authorized $20 million for waiver of use charges for a total program of $149,915,000. The amount authorized for waiver of use charges remains unchanged; therefore, total program as now revised amounts to $153,863,000.

ADDITION TO SUBSECTION (C) TO SECTION 111, PUBLIC LAW 85–162

Section 111 (b) of Public Law 85–162 requires that all cooperative arrangements conform to the program justification data submitted by the Commission in support of its power demonstration reactor programs. Among the data submitted were the terms of the third round invitation under the power reactor demonstration program. That invitation specified that the available forms of Commission assistance would include the loan of heavy water without charge for reactors designed to be fueled with normal uranium. At that time it was expected that requests for waivers of this type would be limited to proposals for normal uranium reactors.

Since then, the Commission has received proposals for reactors of other types which in other respects qualify for AEC support, but which include requests for AEC asistance in the form of a heavy water use charge waiver. Authorization to provide such assistance is therefore requested.

Assistance requested from AEC to date is as follows:

Pennsylvania Power & Light Co.-Westinghouse Electric Corp	$950,000
Carolinas Virginia Nuclear Power Associates	420,000
Total	1,370,000
Florida	450,000

ADDITION OF SUBSECTION (D) TO SECTION 111, PUBLIC LAW 85–162

The proposal of the East Central Nuclear Group-Florida West Coast Nuclear Group for a power demonstration reactor was submitted to the Commission under the third round of the power demonstration reactor program. Although in general the proposal conforms to the criteria of the third round, there are deviations such that the project requires specific authorization.

The objectives of the proposed project are to bring new resources into the development of nuclear power technology, to advance the art, and to accelerate the time when economically competitive nuclear power is achieved. These objectives are to be achieved by a proposed arrangement which is directed to the research and development, construction, and operation of an advanced, high-temperature, gas-cooled, heavy water moderated reactor of the pressure tube type. The reactor would be a unit of about 50 EMW fueled by slightly enriched uranium, which the proposers would design as a prototype of a 200 EMW reactor capable of operating on natural uranium fuel.

The prototype would be constructed and operated on the system of the FWCNG members for a 5-year period.

The project would begin with a research and development phase.

Initiation of construction would be contingent upon:

1. Determination of technical feasibility.

2. An estimate of reactor power costs no more than 50 percent above conventional power costs.

3. Absence of conclusive evidence that some other reactor type would be more economical than a 200-EMW reactor of the type proposed.

Section 111 (b) of Public Law 85-162 requires all cooperative arrangements to conform to the program justification data submitted by the Commission in support of its power reactor demonstration programs.

The proposal deviates from the criteria established by the third round invitation in the following principal respects:

1. The proposal estimates the completion of construction at June 1963 (compared to the June 1962 date in the invitation); and

2. The proposal requests waiver of heavy water use charges for a prototype reactor utilizing slightly enriched uranium (whereas the invitation limits such waivers to normal uranium-fueled reactors). Hence the need for special authorization.

Assistance requested from AEC is as follows:

Preoperation research and development (base)	$5,097,000
Preoperation research and development (overrun at AEC option)	2,549,000
Research and development in AEC facilities	1,000,000
Postoperation research and development	3,000,000
Total funds	11,646,000
Waiver of heavy water use charge	450,000
Waiver of fuel use charge	350,000
Total AEC assistance	12,446,000
Total estimated cost to proposers	43,831,000
Grand total, project	56,277,000

The details of the specific arrangement are set forth in program justification data No. 58-111-5, attached.

ADDITION OF SUBSECTION (E) TO SECTION 111, PUBLIC LAW 85-162

The joint proposal of the Pennsylvania Power & Light Co. and Westinghouse Electric Corp. was submitted to the Commission under the third round of the power demonstration reactor program. Because of questions which have been raised concerning conformance of the proposal with the criteria of the third round, specific authorization is requested.

The objectives of the proposed project are to bring new resources into the development of nuclear-power technology, to advance the art, and to accelerate the time when economically competitive nuclear power is achieved. These objectives are to be achieved by a proposed arrangement which is directed to completion of a research and development program leading to determination of the technical feasibility of a large-scale nuclear powerplant of the single-region slurry homogeneous type, designed to produce 70,000 to 150,000 net electric kilowatts of energy. The arrangement described above is hereinafter referred to as phase I. Congressional authorization is requested only for the project described as phase I.

Assistance requested from the Commission for phase I consists of preconstruction research and development up to a ceiling of $7 million.

Upon a determination of technical feasibility at the end of phase I, the proposers will either notify AEC of their willingness to proceed with phase II of the project (consisting of continued research and development, construction, and 5 years' operation of the reactor), or will repay to AEC the funds paid out by AEC under phase I. If the proposers are prepared to proceed and AEC also desires to proceed, phase II will be submitted to Congress for authorization in accordance with the requirements of section 261 a (2) of the Atomic Energy Act. Upon proper authorization, the parties will then enter into a supplemental agreement for phase II upon terms and conditions to be set forth in the definitive phase I contract, subject to any changes which may be acceptable to AEC.

The details of the specific arrangement are set forth in program justification data No. 58–111–6 (phase I), attached.

Appendix 2

United States Atomic Energy Commission Analysis of Proposed Bill for Authorization of Appropriations Under Section 261 of the Atomic Energy Act of 1954, as Amended—Plant Acquisition and Construction, Fiscal Year 1959 (H. R. 12459 and S. 3785)

To authorize appropriations for the acquisition or condemnation of real property or facilities, and for plant or facility acquisition, construction, or expansion for the atomic-energy program.

The proposed bill would authorize appropriations for additional capital outlays totaling $193,379,000 for the atomic-energy program. Authorization is required under the provisions of section 261 of the Atomic Energy Act of 1954, as amended (Public Law 703, 83d Cong.).

The estimate of appropriations to be authorized is based on the following requirements:

Page No.	Project No.	Item	Estimated cost
4	59-a-1	Plant modifications for processing of nonproduction spent fuels, undetermined sites	$15,000,000
5	59-a-2	Pilot plant for fabrication of new fuel elements, Fernald, Ohio	335,000
6	59-a-3	Reduction of fire hazards—phase II, gaseous diffusion plants, Oak Ridge, Paducah, and Portsmouth	11,900,000
7	59-a-4	New waste-storage installations, Arco, Idaho	3,200,000
8	59-b-1	Weapons production and development plants, locations undetermined	10,000,000
9	59-b-2	Component fabrication plant, Hanford, Wash	3,500,000
10	59-b-3	Fabrication plant, Oak Ridge, Tenn	12,500,000
11	59-b-4	Special processing plant, Mound Laboratory, Ohio	2,000,000
12	59-c-1	Storage-site modifications, various locations	1,500,000
13	59-c-2	Base construction, Eniwetok Proving Ground	2,342,000
15	59-c-3	Base construction, Nevada test site	1,780,000
16	59-c-4	Test-area development, Nevada test site	600,000
17	59-c-5	Phermex installation, Los Alamos, N. Mex	2,250,000
19	59-c-6	Laboratory building, TA-33, Los Alamos, N. Mex	590,000
20	59-c-7	Test and environmental installations, Sandia Base, N. Mex	1,488,000
22	59-c-8	Lineal acceleration tester, Livermore, Calif	390,000
23	59-c-9	Test assembly building	510,000
24	59-c-10	High-explosive development plant, Livermore, Calif	2,000,000
25	59-c-11	Storage and handling building, Livermore, Calif	250,000
26	59-d-1	Reprocessing pilot plant, Oak Ridge National Laboratory, Tennessee	3,500,000
27	59-d-2	Special purpose test installation	2,300,000
28	59-d-3	Fast reactor safety testing station, Navada test site	1,367,000
29	59-d-4	Army reactor experimental area (AREA), Arco, Idaho	1,000,000
30	59-d-5	Hot cells	5,000,000
31	59-d-6	Army package power reactor No. 2	3,000,000
32	59-d-7	Modifications to organic moderated reactor experiment (OMRE), experimental boiling water reactor (EBWR), and boiling reactor experiment (borax)	6,300,000
33	59-d-8	Heavy water component test reactor	8,000,000
34	59-d-9	Fuels technology center addition, Argonne National Laboratory, Illinois	5,000,000
35	59-d-10	Gas-cooled power reactor	51,000,000
37	59-d-11	Project Sherwood plant	2,000,000
38	59-e-1	Accelerator improvements, University of California Radiation Laboratory, California	500,000

Page No.	Project No.	Item	Estimated cost
39	59-e-2	CP-5 reactor improvements, Argonne National Laboratory, Illinois	$500,000
40	59-f-1	Installations for support of research dealing with radioactive fallout and related radiation hazards	2,000,000
41	59-g-1	Additional plant for the Regional Nuclear Training Center, Puerto Rico	500,000
42	59-g-2	International Atomic Energy Agency research reactor and laboratories	2,000,000
43	59-g-3	Gamma process development irradiator	1,600,000
44	59-h-1	School storage building, Hanford, Wash	75,000
45	59-i	General plant projects	25,602,000

In addition, the proposed bill includes amendments to the following previously authorized projects:

Page No.	Project No.	Item	Estimated cost
46	----------	Expenses for move to new principal office	$210,000
47	58-111	Cooperative power reactor demonstration program	156,672,000

The proposed bill also includes language which would permit construction of project 59-d-10, gas-cooled power reactor, under either a cooperative arrangement or with Government financing.

Page 48, section 110; gas-cooled power reactor.

59-a-1 Plant modifications for processing of nonproduction spent fuels, undetermined sites, $15 million

This project is to provide, through necessary plant modifications and additions to existing facilities, the capability for processing, on a routine basis, irradiated fuels from nonproduction reactors. Separation facilities at Hanford, Idaho, Oak Ridge, and Savannah River will be used. The modifications to existing facilities include the installation of new dissolver systems, changes to some of the extraction systems, installation of handling and disassembly equipment, changes to waste storage and disposal areas, and installing pipelines between the various processing and waste-storage areas. Other miscellaneous modifications will also be necessary.

The processing of these fuels from licensed reactors will be for an interim period until industry can provide necessary capability with private capital. In the event and to the extent that satisfactory industrial proposals are received to process AEC fuels, it may be necessary to utilize all or a part of the funds made available pursuant to this authorization to cover contingent liabilities associated with plants processing the AEC load.

Nonproduction fuels will have to be processed because of the high monetary value of the contained source and special nuclear materials, the AEC commitment to provide processing services to reactor operators, and the need to determine the SSNM content of the fuel elements by dissolution for settlement of accounts with the reactor operators. In addition, the lack of adequate long-term storage capacity for the size and level of activity of the discharged elements is additional justification for processing the returned fuel elements.

The estimated cost of completing the modifications and additions to existing facilities is based on early exploratory work on processes which show promise and on the construction and operating knowledge accumulated over the past number of years by the AEC. It is not feasible with the current state of process development and knowledge of the fuel composition and geometry to present the usual breakdown of the cost estimate. The cost estimate of $15 million, therefore, must be considered an order-of-magnitude estimate.

59-a-2 Pilot plant for fabrication of new fuel elements, Fernald, Ohio, $335,000

This project provides for the construction of a building and necessary equipment for a pilot plant to fabricate special uranium shapes. At the present time adequate space is not available to house equipment required to fulfill Commission requirements for special orders thus causing frequent downtime for dismantling and removal of some machinery and replacement with other machin-

ery necessary for the job at hand. The facility to be built will permit fabrication of special orders of normal and enriched uranium without the problem of cross-contamination in quantities sufficient to fulfill expected Commission requirements.

Cost elements are:

Engineering, design and inspection	$28,000
Construction	104,000
Equipment	176,000
Contingency	27,000
Total	335,000

59–a–3 Deduction of fire hazards, phase II, gaseous diffusion plants, Oak Ridge, Paducah and Portsmouth, $11,900,000

This project provides for the fire protection in gaseous diffusion plants in addition to that undertaken under project 58–b–7 authorized by Public Law 85–162, August 21, 1957. The work contemplated under this project will be in the two remaining gaseous diffusion buildings (K–25 and K–27) at Oak Ridge and in all the principal auxiliary process facilities having insulated metal roof deck construction at Oak Ridge, Paducah and Portsmouth.

The proposed measures, while not final in scope, provide for automatic sprinkler protection, the extension of the supervisory alarm systems, the installation of sheet metal shields and modifications to the lube oil system. The overall objective is to reduce the vulnerability of these production facilities to potential fire hazards, to reduce the damage to production facilities to a minimum in case of fire and thereby further insure continued uninterrupted operation of existing gaseous diffusion plants.

Cost elements are:

Engineering, design and inspection	$585,000
Construction	9,760,000
Contingencies	1,555,000
Total	11,900,000

59–a–4 New waste storage installations, Arco, Idaho, $3,200,000

This project is to provide waste tanks for the storage of radioactive waste discharged from the chemical separation processes at the Idaho chemical process plant, and associated treatment and disposal facilities. The radioactive waste solutions will be of varied composition and activity and generally of a very corrosive nature depending on the type of fuel element being processed and in all cases the storage of wastes will be in stainless steel tanks. The tanks will be utilized to store wastes from processing fuels received from both research, development and power reactors.

Cost elements are:

Engineering, design, and inspection	$330,000
Construction:	
Control house	200,000
Waste tanks	1,655,000
Yard piping	600,000
Electrical instrumentation	115,000
Contingency	300,000
Total	3,200,000

59–b–1 Weapons production and development plants, locations undetermined, $10 million

This project provides for the construction and acquisition of such additional production and development facilities as may be required to further the weapons program. The specific nature of these facilities cannot be forecast at this time; however, future production and development programs indicate that additional facilities will be required, either in the way of increased capacity or to cope with new techniques or both. This project will assure availability of funds to meet new production requirements and to provide research and development facilities in order to take early advantage of advances in the weapons field.

Research and development in new types of weapons and modifications to existing weapons are ordinarily not confirmed until field tested at overseas or continental test sites. When successfully tested, the work progresses rapidly into the final development, engineering for production, and production stages. Specific facilities which may be required by these stages are dependent on the particular idea which has been successfully field tested and cannot, in many cases, be predicted in sufficient time for inclusion in the regular budget submission.

Until the parameters of new weapons can be accurately defined it is not possible to foresee all of the development, production, and environmental testing operations that may be involved and whether existing facilities are adequate to accomplish the programs. The introduction of new materials requiring new development techniques and manufacturing processes creates need for additional plant that cannot be anticipated for inclusion in the budget. New environmental conditions to which weapons will be subjected in supersonic carriers will require facilities where weapons and weapons components can be tested in simulated environments to insure reliability. The environments to be encountered may not be fully known in advance of the regular budget submission.

Similar projects in prior fiscal years have made it possible to proceed with the timely acquisition of facilities to exploit research and development findings and to expand production plants. A like project in fiscal year 1959 will enable the AEC to take early advantage of advances in the weapons field.

Since this project is of a contingent nature, no breakdown of specific cost is available.

59–b–2 Component fabrication plant, Hanford, Wash., $3,500,000

This project is designed to provide Hanford with the necessary minimal facilities to fabricate weapon components. The proposed project can be provided at Hanford at comparatively nominal cost through maximum use of existing facilities. Adequate process area and services are available within the existing fabrication facilities. As currently conceived, new equipment will be provided for necessry processing and for the various quality control and auxiliary functions. Architectural revisions to the building will be made to accommodate equipment installation, to provide adeqaute ventilation, and to provide access to operating areas.

Cost elements are:

Engineering, design, and inspection	$350,000
Construction (building modification)	300,000
Utilities	50,000
Equipment	2,320,000
Removal costs, less salvage	160,000
Contingency	320,000
Total	3,500,000

59–b–3 Fabrication plant, Oak Ridge, Tenn., $12,500,000

Technological advances in weapons development have resulted in the need for new fabrication facilities at Oak Ridge. This project provides for the establishment of a machine shop in an existing building. The work will consist generally of the installation of necessary equipment, building modification and alteration, and extensions to existing utility and other building services.

Authorization for $12.5 million is requested, this being reduced to $8.8 million in appropriation requirements with the transfer of $3.7 million in equipment anticipated to be made available within the AEC complex.

Cost elements are:

Engineering, design, and inspection	$400,000
Construction (building modification)	1,100,000
Utilities	100,000
Equipment	9,760,000
Contingency	1,140,000
Total	12,500,000

59–b–4 Special processing plant, Mound Laboratory, Ohio, $2,000,000

This project will provide a capability for special processing in an existing building at the Mound Laboratory. Extensive building changes and service modification will be required to accommodate the equipment to be installed.

Cost elements are:

Engineering, design, and inspection	$200, 000
Construction (building modification)	250, 000
Utilities	50, 000
Equipment	1, 200, 000
Contingency	300, 000
Total	2, 000, 000

59–c–1 Storage site modifications, various locations, $1,500,000

Experience gained through the use of storage sites as originally designed and constructed reveals that modifications and additions to existing plant are required to correct deficiencies in order to improve operating conditions and to achieve greater efficiency.

Typical of the types of work to be accomplished under this project are (*a*) repair and extensions to service and patrol roads: (*b*) installation of fire alarm and sprinkler systems; (*c*) additions to water storage capacity and demineralization facilities and (*d*) additions to storage structures.

Because of the various types of construction envisaged under this project, it is not feasible to furnish a cost breakdown.

59–c–2 Base construction, Eniwetok Proving Ground, $2,342,000

This project includes the construction of base facilities at Eniwetok and Parry Islands. These facilities are considered necessary to the safe and efficient accomplishment of test operations at the Eniwetok Proving Ground. A summary list of the proposed construction is as follows:

	Estimate
A. Eniwetok Island:	
Hangar and lean-tos	$998, 000
Aairfield improvements	249, 000
POL farm rehabilitations	300, 000
Subtotal	1, 547, 000
B. Parry Island:	
Cold storage warehouse	247, 000
Water distillation facilities with reservoir	318, 000
Subtotal	565, 000
C. Miscellaneous items, both islands	230, 000
Total	2, 342, 000

59–c–3 Base construction, Nevada test site, $1,780,000

This project, covering several items of additions and replacements as indicated below, recognizes and attempts to correct inadequacies in plant at the Nevada test site. Facilities erected for operations of brief duration for one weapon laboratory have been, with very minimum additions and replacements, supporting operations greatly increased in size, scope, and duration at the technical direction of two laboratories. The most critical needs as indicated on the lists below are for working space (in laboratories, in shops, and in offices) and for storage space and utilities:

Additional scientific gear storage	$141, 000
2 water wells in forward areas	110, 000
Permanent control signal cable	225, 000
Technical laboratory at Camp Mercury	150, 000
Electronics shop	147, 000
HE storage magazine	75, 000
Feeding facility, forward area	102, 000
Expansion of utility lines	175, 000
Additions to control point laboratory building	75, 000
Office building	200, 000
Miscellaneous additions and modifications	380, 000
Total	1, 780, 000

Cost elements are:

Engineering, design and inspection	$161,800
Land improvements	93,100
Buildings	1,024,600
Equipment	74,200
Utilities	426,300
Total	1,780,000

59–c–4 Test area development, Nevada, test site, $600,000

This project consists of 10 miles of a primary surfaced highway and a permanent electrical distribution and signal system to a test area at NTS.

During Operation Plumbbob test series the feasibility of contained underground nuclear detonations was the subject of an experiment at a new remote firing area called the tunnel site. For this experiment temporary roads to the new area were provided, power requirements were met by a portable generator and, since a minimum of instrumentation was required, temporary cable and field wire installations sufficed.

The results of the underground test demonstrated that some nuclear devices may be detonated underground and radioactive fallout completely contained. Such testing will require a larger and more extensive system of tunnels in the area and dictate the permanent road, utility and signal system indicated above.

Cost elements are:

Engineering, design, and inspection		$60,000
Construction		480,000
Land improvement (road)	$230,000	
Utilities	250,000	
Contingency		60,000
Total		600,000

59–c–5 Phermex installation, Los Alamos, N. Mex., $2,250,000

This project will provide a weapons diagnostic facility, and special firing and detection equipment and facilities. The building will be of reinforced concrete construction with concrete thickness adequate to withstand shock during firing, and the Phermex bunker and control building will have protective earth shielding. This facility will be located in a remote technical area at Los Alamos.

Cost elements are:

Engineering, design, and inspection	$111,000
Construction	1,040,000
Improvements to land	30,000
Utilities	40,000
Equipment	737,000
Contingency	292,000
Total	2,250,000

59–c–6 Laboratory building, TA–33, Los Alamos, N. Mex., $590,000

This construction will provide a 10,800-square-foot laboratory building for the LASL personnel engaged primarily in the development and testing of specialized components for weapons systems in a remote area.

This group is now performing its functions in widely separated areas. Special facilities have been constructed at a remote site for use in specialized experiments and processes requiring the use of high explosives and radioactive materials, but laboratory, engineering, and general office space has not yet been provided. In the interim, the latter type space is temporarily and quite inadequately provided in the administration building in the main technical area. The greatest disadvantage of this temporary arrangement, and one which is seriously slowing the work, is that a great deal of technical and scientific man-hours are lost in traveling between the 2 points, a distance of nearly 10 miles.

Cost elements are:

Engineering, design, and inspection	$36,500
Construction	432,000
Improvements to land	13,000
Utilities	10,500
Equipment installation (equipment on hand)	15,000
Equipment	28,000
Contingencies	55,000
Total	590,000

59-c-7 Test and environmental installations, Sandia Base, N. Mex., $1,488,000

This project consists of four separate facilities as follows:

(1) Complex wave system facility, $711,000: This construction consists of a 2,000-square-foot reinforced concrete building, including a vibration table with a capacity of 25,00 pounds force, a 1,500 kilovolt-ampere transformer with switching gear, an electronic amplifier, and associated instrumentation. This facility is needed to duplicate as closely as possible the multiple-vibration environments encountered under flight conditions which will exist in future weapons programs. Construction will start in September 1958, and be completed March 1959.

(2) Heated air wind tunnel facility, $425,000: This facility consists of a small wind tunnel duct with a high-heat element to reheat the incoming air. This facility will be used in a 2,800-square-foot building to be constructed adjacent to the existing wind tunnel, and will utilize the existing air storage and air compressor facilities. This additional high temperature tunnel is required to simulate the extreme heat encountered by warheads in supersonic flight, so that their reaction to this environment can be determined and design accomplished to allow for these conditions. Construction will start September 1958, and be completed in May 1959.

(3) Low frequency vibration facility, $212,000: This project consists of a small (1,000 square feet) quonset-type structure protected by earth on the top and three sides, a 12-foot by 16-foot utility building, an explosion proof low-frequency vibration system, with associate local and remote control systems. Weapon programs require vibration tests in the low-frequency range, but there are currently no facilities either at Sandia or elsewhere for performing these tests.

(4) Acoustic testing facility, phase I, $140,000: This facility has been planned in two phases. The high-intensity sound system falls into two general categories, i. e., electrical (phase I) and mechanical (phase II). This requests covers the requirements for phase I which includes a 1,500 square feet building and an audio amplifier with associated utilities, controls, and instrumentation. Phase II is expected to be requested in fiscal year 1960.

Cost elements for these facilities are:

Engineering, design, and inspection	$50,800
Improvements to land	10,000
Buildings	224,400
Utilities	167,500
Equipment	950,000
Contingency	85,300
Total	1,488,000

59-c-8 Lineal accelerating tester, Livermore, Calif., $390,000

This project consists of an 800-square-foot building, launching tube, and operations area, and the necessary special foundations and utilities.

This facility will permit the Sandia-Livermore branch to perform tests to measure the shock characteristics of parts of warheads designed by UCRL, and to explore new configurations designed to withstand severe field use conditions.

The facility will be more economical than the present ballistic flight tests, and will provide more valuable data due to the elimination of free-fall air drop variables.

Construction will start September 1958 and be completed in May 1959.

Cost elements are:

Engineering, design and inspection	$5,000
Improvements to land	12,500
Acceleration tester	325,000
Utilities	12,750
Contingency	34,750
Total	390,000

59–c–9 Test assembly building, $510,000

This project consists of a 10,400-square-foot main building with guardhouse and necessary security fencing and lighting, and utilities.

This facility is required to replace existing facilities which were not designed for the work being performed.

Cost elements are:

Engineering, design and inspection	$32,000
Improvement to land	55,500
Buildings	329,000
Utilities	50,000
Contingency	43,500
Total	510,000

59–c–10 High explosive development plant, Livermore, Calif., $2,000,000

This project will provide for additional facilities at the University of California Radiation Laboratory's high explosive research and development area (site 300). The site was established in 1955 to provide for the research, development and testing of high explosives in support of the UCRL weapons research program. Construction authorizations through fiscal year 1958 have provided facilities in the firing area, where detonations are conducted. However, the high explosives processing area facilities are limited.

Some physical test facilities have been provided by prior authorization, but the advancement of the UCRL weapons program will require an expansion of these test facilities in the areas of physical, chemical and environmental testing. The increase in the technical facilities will require the improvement of the road leading to the site, and roads and utilities to the new facilities.

Cost elements are:

Engineering, design and construction	$130,000
Buildings	706,000
Improvements to land	344,000
Other structures	67,000
Utilities	177,000
Equipment	410,000
Contingencies	166,000
Total	2,000,000

59–c–11 Storage and handling building, Livermore, Calif., $250,000

This project will provide a 20,000 square foot medium-high bay addition to the central stores building. The central stores building was constructed in 1956 primarily to serve as a storeroom and distribution point for small stores items. Due to lack of storage facilities, large warehouse items are currently stored in four old barracks buildings that are not fireproof, and which are of low-bay, narrow specifications that do not permit efficient warehouse handling. Because of their design, the storage height in these old buildings is limited, and the use of timesaving equipment such as fork-lift trucks is not possible.

The need for an adequate, fireproof, centralized storage area for these large items is urgent. A comparison of the space in the barracks buildings with the proposed addition is as follows:

	Gross square feet	Usable cubic feet
Barracks buildings 164, 165, 166, 167	20,034	113,960
Proposed addition	20,000	196,336

The square footage will remain the same, but the cubic footage will increase over 70 percent.

Cost elements are:

Engineering, design and inspection	$19,000
Construction	193,000
Utilities	4,000
Removal cost	13,000
Equipment	2,000
Contingencies	19,000
Total	250,000

59–d–1 Reprocessing pilot plant, Oak Ridge National Laboratory, Tennessee, $3,500,000

This project provides for the design, construction and equipping of additions to the present ORNL Thorex pilot plant, metal recovery plant, and multicurie fission products pilot plant so as to integrate their operation to study the various chemical "head end" processing techniques which have been under development for the past several years. It is planned to combine the existing pilot plant installations by means of an additional cell, mechanical handling area, and canal.

The Commission is now engaged in the development of new process and engineering approaches to reactor fuel reprocessing on a laboratory and cold unit operations basis. These new processes and engineering developments must ultimately be demonstrated on a pilot plant scale before they can be considered proven for use in privately owned plants. The nature of the hot operations involved makes it highly unlikely that such demonstrations would ever be performed by private industry. To be conclusive, this demonstration must include the reprocessing of significant quantities of fuel at full activity levels.

The integrated systems will be capable of processing varying quantities of depleted to highly enriched uranium, plutonium or thorium, and of demonstrating fission product recovery from wastes. Part of the integrated complex will also contribute to various military program requirements and will provide unique plants for the eventual recovery of certain power reactor, thorium-containing fuels under the interim processing program. "Custom" recovery jobs will continue to be performed but at higher activity levels than heretofore. All of these operations will also tend to insure a continuing feed to the multicurie fission products plant.

Cost elements are:

Engineering, design and inspection	$545,700
Improvements to land	25,000
Buildings	486,400
Other structures	138,000
Equipment and installation	1,721,200
Utilities	213,400
Contingency	370,300
Total	3,500,000

9–d–2 Special purpose test installation, $2,300,000

This project provides for the construction of two test cells, transfer and storage locks, a control room, hot and cold change rooms, an area monitoring room, mechanical and electrical support rooms, a filter and hot-gas compressor room, a hot-waste storage system, and security control station.

The structural part of the project, excluding the test cells, will be approximately 7,700 square feet. The test cells will be about 2,400 square feet and will be constructed of reinforced high density and standard concrete. A high-bay superstructure over the test cells will be about 2,500 square feet and will accommodate an inclined 15-ton gantry crane to service the hot-waste storage area. This superstructure will have insulated metal siding. A 5-ton bridge crane and 10-ton monorail will serve the plug outlets. The control room and mockup areas, adjacent to the high bay, will be about 3,500 square feet. The 1,700-square-foot mechanical-electrical and compressor room will be a 1-story superstructure with concrete foundations, structural framing, and prefabricated metal siding and roof. Other supporting units will be included.

Cost elements are:

Engineering, design and inspection	$184,000
Improvements to land	92,000
Test cells area	692,000
High bay	93,000
Mechanical-electrical and filter room	100,000
Control and preassembly area	85,000
Utilities	5,000
Equipment	774,000
Contingency	275,000
Total	2,300,000

59–d–3 Fast reactor safety testing station, Nevada test site, $1,367,000

This project provides fast reactor safety development and proof testing facilities capable of safety testing fast reactors of various types including both molten and solid fueled concepts. It will consist of a test coil covered by a 40 foot by 40 foot warehouse-type structure with the heat dissipation incorporated in the shielding side; since these could be damaged or contaminated during testing to an extent requiring abandonment, they will not be capitalized. Permanent facilities to be constructed at this time consist of cooling pit, remote control facilities, supporting utilities, etc. Electrical power for normal operations will be brought in from the nearest network and a 500-kilowatt emergency power station will also be installed in the area in the event of power failure during operations. Moderate type roads will be required to and within the testing area; water supplies sufficient for the short period operations will be hauled in and stored. Trailers will be used as the need arises to handle personnel and equipment * * * for this purpose, power outlets and parking space for the trailers will be provided in the control area.

Control and instrument recording for the fiscal year 1959 exploratory work will be done in trailer-type laboratories. Planning for subsequent fiscal years for a permanent control room, laboratory, and office building will be started after the initial experience with the testing operations has given information as to the requirements.

Before fast reactors may be accepted for civilian use for power generation, development and proof testing is required. To this end, a fast reactor safety testing program is required at a remote area for which the Nevada test site has been selected. Since, at this early state of planning, it is uncertain as to how frequently such tests will take place, the philosophy followed is to plan for a minimum type installation. The project should be adequate (with the aid of trailers) for the complete testing of only one reactor in a test operation.

Details of cost estimate:

Engineering, design and inspection at 10 percent of construction costs	$115,000
Improvements to land	373,000
Cooling pit	120,000
Remote control facilities	370,000
Utilities	210,000
Contingencies at approximately 15 percent of other costs	179,000
Total	1,367,000

59–d–4 Army reactor experimental area (AREA), Arco, Idaho, $1 million

This project will consist of the engineering and construction of an experimental area to provide technical support to all reactors planned or underway for the Army power reactor program at the National Reactor Testing Station, Idaho. Examples of the facilities to be included: hot cells, a shop, and maintenance building, etc.

Two Army power reactors are currently underway at the National Reactor Testing Station. These are the Argonne low power reactor scheduled for completion in fiscal year 1958, and the gas-cooled reactor experiment scheduled for completion in fiscal year 1959. It is probable that four more Army power reactors will be located in the general area of the NRTS by 1965, assuming receipt and acceptance by the Commission of requirements from the Department of Defense. It is anticipated that the 4 will consist of a prototype gas-cooled reactor, 2 compact reactor experiments, and a prototype compact reactor.

The magnitude and number of activities planned indicate that extensive supporting technical services and installations will be required. Substantial savings will be possible if many of these services and activities are grouped in a centrally located technical support area. Installations which can profitably be grouped in this manner will be constructed under this project.

Cost elements are:

Engineering, design and inspection	$65,000
Hot cells	475,000
Shop and maintenance building, etc	50,000
Roads, parking and walks	30,000
Service lines (water, heat, electricity)	50,000
Equipment	200,000
Contingencies	130,000
Total	1,000,000

59–d–5 Hot cells, $5 million

This project is for the construction of hot-cell facilities at various AEC laboratory locations. These cells will be located in appropriate buildings whose structures will probably be steel framing with reinforced concrete floors, metal roof panels, and built-up roof. Exterior walls will undoubtedly be of masonry construction. Each cell will be stainless steel lined, constructed of high density concrete and equipped with manipulators and high density viewing windows.

A similar project was authorized in fiscal year 1958 and $3,500,000 was appropriated. The amount required for fiscal year 1959 is to provide additional hot cells urgently required for the reactor development program.

Estimated cost elements are:

	Item costs	Total costs
Engineering, design, and inspection, at 14.5 percent of construction costs		$580,000
Construction:		
Improvements to land		0
Buildings		1,350,000
Structure	$950,000	
Building services	425,000	
Equipment and installation		2,475,000
Utilities		100,000
Contingencies, at 11 percent of other costs		495,000
Total estimated cost		5,000,000

59–d–6 Army package power reactor, No. 2, $3,000,000

This project covers engineering and construction of a prototype packaged nuclear powerplant. The DOD will contribute funds necessary for the development of the conventional components of this plant.

Emphasis will be placed on achieving a low-cost plant requiring a minimum of attention for operation and maintenance and which will draw extensively on technology developed in current reactor development programs, but will require extensions of the state of development to approach an optimum military system.

The plan visualized in this project is comparable to the APPR–1, however, it is to be designed to be preassembled into a minimum number of packages for rapid field erection.

It is anticipated that construction of the prototype packaged power reactor will be performed under lump sum contract by an industrial contractor.

59–d–7 Modifications to organic moderated reactor experiment (OMRE), experimental boiling water reactor (EBWR), and boiling reactor experiment (BORAX), $6,300,000

Reactor experiments are originally designed with the limited objectives of proving the technical feasibility of the concept or design approach. Full flexibility is not usually incorporated initially because all possible avenues of research and testing cannot be known before operating experience is obtained. Successful or even unsuccessful operation of the original experiment leads to the need for modifications to exploit promising approaches or to correct problems that reactor operation uncovers. This project is for modifying the OMRE,

EBWR, and the BORAX reactors which are designed for thermal outputs in excess of 10,000 kilowatts.

Although the nature and extent of modifications to the reactor equipment cannot be fully determined at this time, the following is an indication of the work to be done.

EBWR: Modifications to permit analysis and comparison of the plant's performance with D_2O and H_2O using both forced and natural circulation of the coolant moderator. These modifications are necessary to determine the maximum capabilities of the plant with the present metallic core and with subsequent oxide and metallic cores.

BORAX: The present BORAX facility was designed as a low cost, short term experiment. The reactor pit was not coated or lined with a thermal shield. The same pressure vessel, pit, thermal shield, and associated equipment has been used for BORAX I, II, III, and IV. As a result of this extended use, the reactor pit, pressure vessel, control rods, and drive mechanisms are beyond repair. It is contemplated to further modify the reactor to construct a BORAX V to provide continuity of testing and experiments.

OMRE: This project contemplates major modifications and improvements in the OMRE at the NRTS to increase the reactor power level and provide flexible facilities for continued study of organic materials for use as reactor coolants and moderators. Modifications will be made to facilitate loading and removal of fuel elements from the reactor; additional building space will be required for laboratories and to house equipment being tested such as prototype steam generators, pumps, coolant and moderator storage, etc.

The preliminary engineering cost estimates total $6,300,000, divided as follows between the 3 subprojects:

EBWR	$3,000,000
BORAX	1,300,000
OMRE	2,000,000
Total	6,300,000

Design will be performed by ANL on the EBWR and BORAX and by Atomics-International on the OMRE.

59–d–8 Heavy water component test reactor, $8,000,000

This project proposes the construction of an experimental reactor of the pressurized water type, D_2O moderated and cooled, together with necessary support facilities adjacent to an existing Savannah River plant production facility to minimize required supporting utilities. No electric generating facilities are proposed.

This reactor is planned to permit testing and evaluation for the purpose of improving fuel elements and other critical components for use in large scale pressurized D_2O power reactors. The pressurized water system will be similar to that visualized for a full scale unit except that the energy of the hot D_2O will be discharged into cooling water. The flow rate and temperature of the heavy water will be measured in order to determine the amount of useful power that could be produced if the necessary equipment were installed, and to provide a basis for extrapolation to larger plants.

Pressurized heavy water cooled and moderated power reactors constitute one class of reactors which may play an important role in the future of nuclear power. Studies already completed and development and evaluation work already in progress indicate that construction and operation of such a reactor is feasible. The design and operation of a full scale power reactor will be determined by a number of factors some of which require the construction and operation of this proposed reactor to acquire the requisite technical data and operating experience.

The preliminary engineering cost estimate is $8 million with approximately $1 million being required for buildings and support facilities, and the balance representing the estimated cost of reactor construction.

59–d–9 Fuels Technology Center addition, Argonne National Laboratory, Illinois, $5,000,000

This project provides for an expansion of a wing to the Fuels Technology Center. It will be used for development of fabrication methods for low alpha fuel and reactor materials. The structure will be reinforced concrete faced with brick. Approximately one-half of the wing will be high bay space; the areas

included are as follows: Foundry and fabrication; ceramics; machine shop, jacketing, coating, and welding areas. Also included is the equipment necessary, except that some equipment will be transferred from the present facility. The present areas are to be maintained for core fabrication; equipment of use in the development program, but of little value for major fabrication jobs will be moved to the new facility.

The Argonne National Laboratory has become and is expected to continue to be a major reactor development center. A considerable portion of this overall laboratory program involves the design, construction, and operation of experimental reactors. The Engineering Metallurgy Section of the Metallurgy Division is concerned with the development of reactor components, particularly fuel elements, and, when necessary, with the manufacture of cores and other components for experimental reactors.

Present facilities are not adequate enough to carry on both the development and the manufacturing of cores simultaneously. The development of better components must be held in abeyance while the only available equipment is being used for manufacturing purposes. The expansion of the Fuels Technology Center will permit the conduct of development and manufacturing work simultaneously without the necessity of interleaving as at present.

Details of Cost Estimate

Engineering, design and inspection at 15 percent of construction cost	$379,000
Construction costs, building (63,100 square feet, @ $40)	2,524,000
Equipment	1,642,000
Contingency at 10 percent of other costs	455,000
Total	5,000,000

The A–E work will be performed by cost-plus-fixed-fee subcontracts based on proposals and negotiations. Construction and equipment procurement will be performed on lump-sum contracts and purchases based on competitive bids.

59–d–10 Gas-cooled power reactors, $51,000,000

It is planned to initiate construction of a prototype gas cooled, graphite moderated reactor in fiscal year 1959. Design studies are now being carried out to select a specific reference design for a prototype 40 electrical megawatt plant. Other facilities required, in addition to the reactor systems and facilities to house the reactor and operating personnel, include turbine generator, warehouses, induced draft cooling power, substation, and necessary utilities.

The need for this facility is based on initiation of a broad United States program for the development of civilian gas-cooled power reactors. Recent intensive design studies have pointed up the potential of gas-cooled graphite moderated reactors using partially enriched uranium fuel for economic power generation. Development of this potential requires construction and operation of a reactor prototype to obtain construction experience and establish operating characteristics and to provide for the testing of materials and fuel elements for more advanced versions of this concept.

Details of the cost estimate are:

Engineering design and inspection		$5,300,000
Construction costs		35,530,000
Site work	$1,010,000	
Buildings	4,440,000	
Reactor	12,990,000	
Power generation	15,360,000	
Electrical distribution	1,730,000	
Contingency, 25 percent of other costs		10,170,000
Total		51,000,000

The AEC has determined that construction of this reactor is warranted and desirable. Accordingly, it will invite industrial participation in the development, final design, construction, and operation of a gas-cooled graphite moderated reactor prototype of about 40,000 electrical kilowatts of electrical output which is the minimum size consistent with the objectives of this project.

In its invitation, the AEC will reaffirm that it is the policy of the Commission to promote the development, construction, and operation of nuclear powerplants

as justified by their technological status under the best arrangement that can be obtained.

In the event a fully responsive proposal for a reactor of this type and developmental potential is not received and judged acceptable for negotiation within a reasonable time after the the announcement, the Commission will proceed with immediate construction of a gas-cooled power reactor with total Government financing.

In order to assure maximum rate of progress, the Commission will continue development and design work now underway in connection with this reactor type.

59–d–11 Project Sherwood plant, $2,000,000

This project provides for the construction of supporting installations necessary at the several sites where controlled thermonuclear research is in progress. The controlled thermonuclear program, which has as its goal the controlled release of energy from the fusion of light nuclei, is being actively pursued at four major sites (Oak Ridge National Laboratory, Los Alamos Scientific Laboratory, Princeton University, and the University of California Radiation Laboratory, at Livermore) and is also supported by smaller projects at a number of other sites.

Decisions concerning the assembly of rather sizable experimental models and their supporting installations in the controlled thermonuclear program are largely dependent upon the successful operation of smaller models and the resolution of a number of technical and theoretical problems. Recent developments in the controlled thermonuclear program indicate that the extent of the progress in this field will be sufficiently advanced by fiscal year 1959 to warrant the initiation of one or more models of such size that additional facilities for the development program and housing for machines may be required. In addition, since the United States will disclose at the Geneva Conference in September 1958 most, if not all, of its progress in Project Sherwood, the Commission must be prepared in fiscal year 1959 to push toward newer and more promising results in the program. Continued progress may be delayed if construction funds are not available for use immediately when needed. To cover these eventualities, this project provides $2 million for the construction of supporting facilities whenever necessary at the several sites where controlled thermonuclear research is in progress.

The details of the cost elements are not available at this time.

59–e–1 Accelerator improvements, University of California Radiation Laboratory, California, $500,000

This project provides for accelerator improvements to the existing accelerators at the University of California Radiation Laboratory. It includes improvements to the Bevatron, the 184-inch cyclotron and the heavy ion linear accelerator and to the research equipment and other installations which are required and utilized in conducting experiments with these machines. Included are such items as systems for proton beam deflection and extraction, direct current power systems, shielding, a scattering chamber, and a motor generator set.

The additions and improvements to the Berkeley accelerator and research installations used in conjunction with the accelerators are required in order to increase the versatility, effectiveness and utilization of these machines as research tools. The research program at Berkeley contemplates an increase in the variety and number of experiments utilizing the accelerators. Accordingly, improved accelerator utilization, efficiency, and versatility must be obtained. These improvements will provide for increasing the utilization of the accelerators and for increasing the scope and type of experiments which can be conducted with the machines and will add to the potentiality of developing new data in the physical research program.

The cost elements pertaining to this project are not available at this time.

59–e–2 CP–5 reactor improvements, Argonne National Laboratory, Illinois, $500,000

This project will provide for an increase in the power level of the CP–5 reactor from 4 megawatts to 10 megawatts. The additions and modifications necessary to accomplish this will include: additional cooling tower capacity, water-cooled shielding plugs, improved emergency shutdown cooling for the reactor, a hot cave, a new lead coffin with accessory handling equipment, and a fuel storage canal.

An increase to 10 megawatts will raise the flux of the CP–5 to about 1014 and will increase considerably the value of the reactor for research experiments. The increased flux will make it possible to conduct studies of some of the transplutonium isotopes that cannot be formed at the present flux levels due to the short half lives and the multiple capture processes involved. In experiments where the neutron chopper is used, the higher intensity of the neutron beam will allow a larger flight path to be used with a resulting improvement in the resolution of the results. Present difficulties with the background radiation will also be minimized and the statistical accuracy of the experiments will be increased.

The increased neutron beam intensity will also permit higher collimation to be utilized with greatly improved resolution of the diffraction peaks obtained for low symmetry crystal structure studies. This will significantly improve the resolution and precision in the nuetron diffraction studies of magnetic structures in the low angle scattering region. Neutron diffraction studies on small single crystals and on small powder samples of rare isotopes will also be feasible. Finally this project will expedite the reactor fuel development program by reducing the time required for irradiations and in-pile fuel irradiation loops. Irradiation damage studies will then be made at Argonne National Laboratory with a considerable savings in time and money. For example, the increased power level will allow the burn-up of EBR–11 fuel elements at a rate as fast or faster than will eventually be realized in EBR–11.

Cost elements are:

Engineering, design, and inspection	$30,000
Construction costs	360,000
Heavy water	72,000
Contingency	38,000
Total costs	500,000

59–f–1 Installations for support of research dealing with radioactive fallout and related radiation hazards, $2,000,000

This project covers construction as may be required to expand the research programs in the studies of radioactive fallout problems and the biological hazards of radiation. The initiation or expansion of long-range studies of radiation effects on man and his environment will require the construction of a number of installatios not otherwise available. These would include, but not necessarily be limited to: (1) dog holding areas, providing holding kennels, runs, disposal units for waste materials, radiobiology and analytical laboratories, etc.; (2) large animal areas (cows, sheep, goats, swine, etc.) providing fencing, shelter, waste-disposal units, and space for laboratories and offices; and (3) development and fabrication of whole body counters for use with human beings and large animals, with heavily shielded enclosures of steel or brick, and counting equipment, including crystals and multi-channel analyzers.

Although the biomedical research program of the Commission has been vigorously pursued, it is now apparent that, as a result of the growth of the atomic energy program and the developments and recommendations of the Joint Committee on Atomic Energy at the radioactive fallout hearings, prompt additional emphasis needs to be placed on studies relating to the biological hazards of radiation and problems of radioactive fallout. This construction is urgently required if we are to obtain the answers to the pressing questions of today and the immediate future.

The detailed cost elements are subject to subsequent programmatic determinations as requirements and priority needs are established.

59–g–1 Additional plant for the regional nuclear training center, Puerto Rico, $500,000

This project provides for the construction of a laboratory at a location convenient to the medical training and research staff and the hospital plant of the school of medicine of the University of Puerto Rico.

During fiscal year 1958 construction is being initiated for the establishment and operation of a regional nuclear training and research center in Puerto Rico to serve Spanish-speaking people in Puerto Rico and Latin America. The fiscal year 1958 phase provides for training and research in nuclear science and engineering.

The fiscal year 1959 phase will provide additional plant for training in the application of nuclear techniques to medicine, particularly to basic medical studies relating to cancer. It will provide for resident physicians to undertake

training, clinical research, diagnosis, and therapy in the field of cancer, applying nuclear techniques. Based on a tentative scope determination, approximately 13,000 square feet of a laboratory-type building will be required.

Cost elements are:

Engineering, design, and inspection		$41,000
Land and land rights		0
Construction cost:		
Improvements to land	$5,000	
Buildings (13,000 square feet, at $27)	351,000	
Utilities	8,000	
Equipment	50,000	
		414,000
Allowance for contingencies		45,000
Total		500,000

59–g–2 International Atomic Energy Agency research reactor and laboratories, $2,000,000

This project provides for the construction, at a site to be determined by the International Atomic Energy Agency, of a research reactor appropriate to the needs of the Agency. It also provides for the construction of such radioisotope laboratories, as the Agency in consultation with the United States determines most needed and appropriate to its program of furthering the peaceful uses of atomic energy on a worldwide basis. The project is now in the planning stage and definitive details are not available. Tentatively, it is assumed that the reactor phase of the project will involve costs of approximately $1.5 million and the radioisotope laboratories, $500,000. (As a basis for costing, a 1 megawatt pool-type reactor and a modern low-level isotope laboratory were hypothesized.) As an alternative, these funds would also be available for a grant to the Agency to provide the above or similar research installations for the Agency.

Subsequent developments, including the possibility of the Agency augmenting the project from funds contributed by other countries, may involve an enlargement of the scope of the reactor phase of the project. It may also be determined necessary to increase the scope of the reactor project by reducing the scope of the planned radioisotope laboratories. In either or any case, equipment and/or capital structures procured by funds involved herein will be identified (through appropriate plaques or otherwise) as provided by the United States, whether or not the Commission actually constructs the installations or grants funds to the International Agency itself for procurement.

The idea of an International Atomic Energy Agency which would not only further the peaceful uses of atomic energy on a worldwide basis, but through the use of appropriate safeguards, including inspections, would ensure that projects fostered or assisted by the Agency will in fact, be confined to peaceful uses, was conceived by the United States. It is to the interest of the United States and its foreign policy that the Agency undertake at an early date a substantive and viable program. Essential to such a program is the need to fill a worldwide requirement for more training and research in nuclear science and technology in all applications. This project will place in the hands of the Agency capital equipment requisite to initiate such training and research.

Cost elements (tentative) are:

Research reactor	$1,500,000
Radioisotope laboratories	500,000
Total	2,000,000

59–g–3 Gamma process development irradiator, $1,600,000

This project provides for the construction of an irradiator at a site to be determined by the AEC after investigation and analysis of potential geographical locations during fiscal year 1958.

The present unavailability of means of achieving a scale-up of research and development from existing kilocurie to megacurie sources constitutes a major gap militating against rapid development of the field of applied radiation in the United States. Immediate need, therefore, exists for an aggressive program to accelerate development of this field. Early realization of the economic potential of high-level radiation applications in industry and assurance of United

States world leadership in nonpower uses of atomic energy require such an effort.

During fiscal year 1958, an extensive analysis and correlation of world technology on sources and uses of high-level industrial irradiation and the technical requirements for immediate and long-range industrial application will be undertaken as a preliminary to a program for accelerating the development of the field of applied radiation in the United States.

The fiscal year 1959 phase will provide irradiation facilities having maximum flexibility as to source type and geometry for high-level irradiation of solids, liquids and gases. The developmental effort will be directed toward demonstration of the efficacy and economic potential of high-level radiation in industrial manufacturing processes. Based on a tentative scope determination, approximately 12,500 square feet of a shielded-type building will be required.

Cost elements (tentative) are:

Construction cost:	
Buildings	$250,000
Utilities	212,500
Equipment	966,000
Allowance for contingencies	171,500
Total	1,600,000

59–h–1 School storage building, Hanford, Wash., $75,000

This project provides for the construction of a cinder-block storage building as an addition to the school maintenance shop to house all active storage items in the Richland School District. At the present time, approximately 1,500 square feet of the school administration building is utilized as storage space for food and cafeteria supplies. The old high school is used to store used furniture, extra equipment, and bulky school supplies.

The construction of this building would (1) make it possible to utilize the present administration building for additional office and workroom space, thus avoiding the need for possible expensive administrative construction, (2) allow the abandonment of the deteriorated old high-school building now used as a storage facility, and (3) consolidate at one location all active storage space of the school district, thus making possible more efficient handling, control, and storage procedures.

Cost elements are:

Engineering, design, and inspection	$6,000
Improvements to land	2,000
Construction	48,000
Utilities	12,000
Contingency	7,000
Total	75,000

59–i General plant projects, $25,602,000

These projects provide for the many miscellaneous minor alterations, additions, modifications, replacements, and minor new construction which are required annually by each of the Commission's operating programs to provide continuity of operation, improvement in production techniques, road and street improvements, elimination of health and safety hazards, minor changes in operating methods, and to protect the Government's investment by preventing excessive deteriorations and obsolescence in the facilities which support the several programs of the Commission.

The criteria under which funds are expended are (*a*) in connection with community operations, no single project can exceed a cost of $100,000 and no new or expanded building in connection with such project can exceed a cost of $10,000; (*b*) in connection with all other programs, the maximum project cost is $500,000 and the maximum building cost is $100,000.

The cost estimate for fiscal year 1959 is based on experience in prior years and takes into account new plant and other facilities which are coming into operation, and certain special nonrecurring projects which, because of their nature, fall within the criteria for general plant projects.

By program, the estimated requirements for fiscal year 1958 and fiscal year 1959 are:

Program	Fiscal year 1958	Fiscal year 1959
Raw materials	$450,000	$300,000
Special nuclear materials	9,800,000	9,365,000
Weapons	7,000,000	6,900,000
Reactor development	5,489,000	6,000,000
Physical research	1,288,000	1,500,000
Biology and medicine	206,000	200,000
Community	850,000	937,000
Administrative	450,000	400,000
Total	25,533,000	25,602,000

Section 108. Expenses for move to new principal office, $210,000

Public Law 85–162 authorized the Commission within a limit of $75,000 to provide or arrange for commuting transportation for employees at the headquarters to the extent necessary and at such charge as to assure an adequate work force where this purpose cannot be achieved by ordinary transportation. Based on experience to date, the cost of providing such transportation through June 30, 1958, will completely exhaust the $75,000 currently authorized. In order to assure an adequate work force, it is considered necessary to continue to provide subsidized commuting transportation for at least an additional 18 months beyond June 30, 1958. Based on limited experience to date, it is estimated that the cost of such transportation in fiscal year 1950 will be $135,000. Additional congressional authorization is required.

Section 109. Cooperative power reactor demonstration program, $156,672,000

Public Law 85–162 authorized appropriation in the amount of $129,915,000 for a cooperative power reactor demonstration program. Based on program developments involving new proposals and changes in proposals before the Commission when Public Law 85–162 was enacted, authorization for appropriation is being requested for fiscal year 1958 in the amount of $133,863,000. Additional requirements for fiscal year 1959 make it necessary to further increase the authorization for appropriation to a new total of $156,672,000 to provide for requirements under the contract with the Power Reactor Development Co. (increase of $2,809,000), and to provide for contracts covering first, second, and third generation power reactors under additional proposals expected under the power reactor demonstration program ($20 million).

The following table sets forth these additional requirements:

[In thousands]

	Revised authorization in fiscal year 1958	Required authorization for fiscal year 1959
First round:		
Fast breeder research and development	$1,500	0
Power Reactor Development Co., preconstruction research and development	0	$4,309
Provision for additional proposals	0	20,000
All other proposals	132,363	132,363
Total	133,863	156,672

In addition to the amount authorized for appropriation, Public Law 85–162 authorized $20 million for waiver of use charges for a total program of $149,915,000. This former amount remains unchanged; therefore, the total program (increased to $153,863,000 in the fiscal year 1958 revised authorization) is now increased for fiscal year 1959 to $176,672,000.

Section 110. Gas-cooled power reactor

This section would provide the Commission with authority to either proceed with construction of the gas-cooled power reactor (project 59–d–10) included

in section 101 of this act with Government financing or through a cooperative program in accordance with section 261 (a) (2) of the Atomic Energy Act of 1954, as amended.

Details of the invitation for industrial participation in the development, design, construction, and operation of a gas-cooled graphite moderated reactor prototype of about 40,000 electric kilowatts of electrical output are included in the analysis of project 59–d–10.

APPENDIX 3

REACTOR FOR THE PRODUCTION OF SPECIAL NUCLEAR MATERIALS—REPORT TO THE JOINT COMMITTEE ON ATOMIC ENERGY BY THE ATOMIC ENERGY COMMISSION

INTRODUCTION

1. This report is prepared and submitted pursuant to Public Law 85–162, section 101, which authorized the Atomic Energy Commission to perform "development, design, and engineering" of a production reactor for special nuclear materials and stipulated that the Commission shall "proceed with sufficient design work, together with appropriate engineering and development work, necessary for the Commission to begin construction, as soon as practicable after authorization by the Congress, of a large-scale, single- or dual-purpose reactor for the production of special nuclear materials." The legislation further provided that "the Commission shall submit to the Joint Committee on Atomic Energy a report on its design for this project, including cost estimates and schedule of construction, not later than April 1, 1958."

2. Pursuant to this legislation, the AEC requested the two companies experienced in the development, design, and engineering of production reactors, the Du Pont Co. (contractor for the Savannah River plant) and the General Electric Co. (contractor for the Hanford plant) to submit a proposed program of studies on alternative types of reactors which could meet the criteria established by the Congress. Following review of the reactor types considered by the Du Pont and General Electric representatives as being responsive to the requirements of the legislation, the AEC authorized Hanford to proceed with development and design of the reactor type outlined by General Electric. The reasons governing this choice were:

(*a*) Although improved versions of either the existing Hanford or Savannah River single-purpose reactor types were indicated as capable of being built on essentially the same time schedule (30–36 months), the indicated capital cost per installed megawatt of heat capacity and unit cost of plutonium production strongly favored the Hanford type.

(*b*) General Electric proposed a new reactor type that could include the flexibility for operation either as a single- or dual-purpose unit, or initially as a single-purpose unit with a later conversion to dual-purpose operation.

(*c*) The proposed new Hanford reactor design offered promise of lower investment cost per thermal megawatt and lower unit cost of plutonium production than the improved version of the existing Hanford K-type reactor, a choice of either single- or dual-purpose operation, and an opportunity to acquire additional valuable technical data from the necessary design and development work.

(*d*) A significant amount of technical data which could be applied to the engineering design of the proposed new reactor had already been developed by General Electric in the continuing research and development program at Hanford, aimed at improving the performance and safety of the existing Hanford production reactors and developing the design parameters for improved production reactors.

3. As pointed out in the AEC notification of October 3, 1957 to the Joint Committee on Atomic Energy of the selection of the General Electric Co. to proceed with the work authorized by the legislation, the reactor chosen as a basis for this work would be a pressurized-water, graphite-moderated, slightly enriched uranium fueled unit designed to operate at high temperatures.

4. The specific objectives of the study were:

(*a*) To estimate the capital and operating costs of new, large-size, single- and dual-purpose reactor facilities at Hanford.

(*b*) To calculate production rates and unit product costs for single-purpose plutonium operation and for a range of byproduct electric power production conditions.

(*c*) To investigate and summarize the development work required to support the alternate plant concepts studied.

(*d*) To develop preliminary information regarding feasible schedules of construction and operation for the concepts considered.

Specific attention was given to investigation of a reactor concept which would be capable of economic production of plutonium as a single-plant product but which also would be capable of conversion to dual-purpose operation or, ultimately, to operation for the production of electric power only.

5. Due to time limitations, it was necessary to limit detailed study to a single Hanford site and to a single basic reactor concept. There are variations in the reactor details, among the alternate cases considered, such as in moderator block design, process-tube wall thickness, pressure rating of the piping and primary loop materials, but number and spacing of process tubes, reflector and shield dimensions, and control systems design are common to all the examples studied, since previous investigations had indicated that varying these factors would have a minor influence on study conclusions.

DESCRIPTION OF THE BASIC REACTOR CONCEPT

6. The basic reactor concept consists of a large block of graphite pierced horizontally by zirconium-alloy process tubes which contain the fuel elements and provide channels for flow of the reactor coolant. This matrix is enveloped by thermal and biological shields provided with suitable passages for the process tubes and the control and safety facilities. The contemplated fuel elements are clusters of cylindrical uranium rods. The graphite stack is comprised of thousands of pieces of machined, especially high-grade, graphite produced from petroleum coke and coal-tar pitch. Special passages are provided in the graphite to permit venting of steam from the tube channels in the event of a tube rupture. The reactor is provided with a primary cooling system designed to remove and transfer the generated heat from the reactor to a secondary cooling system, through a series of heat exchangers for the plutonium-only reactor case, or through a series of steam-generation units in those cases where dual-purpose features are incorporated in the design. For the plutonium-only case, the primary coolant would be demineralized water, recycled through the reactor and heat exchangers under pressure. The secondary coolant would be river water, pumped from the river through the heat exchangers and thence back to the river. For the dual-purpose cases, the primary coolant flows from the recirculation pumps, through the reactor, thence through the tube side of the steam-generation heat exchangers back to the recirculation pumps. The secondary circuit boiler feed water is pumped to the steam-generation heat exchangers for the generation of steam to operate the primary pumps and to extract electric power via turbogenerators. The condensate from these facilities is recycled back, supplemented by demineralized water makeup. Condenser cooling water is taken from, and returned to, the river.

7. Figure 1, appended, provides a general perspective of the new production reactor plant, if built as a dual-purpose facility.

DEVELOPMENT REQUIREMENTS

8. For this basic reactor concept, considered either as a plutonium-only unit or a dual-purpose unit, there are major areas of technological development. The major problem areas listed by General Electric are the following:

(*a*) Provision of a satisfactory fuel element.

(*b*) Establishment of the feasibility of designing for operation of the graphite moderator at high temperatures.

(*c*) Provision of functionally adequate process tubes.

(*d*) Design of a vapor-venting system to dissipate steam, carbon monoxide, and hydrogen gases in the event of a process-tube rupture.

(*e*) Miscellaneous other design development problems, including the following:

1. Comprehensive testing of reactor components to verify stress calculations.

2. Thermal cycling and mechanical strength tests of process-tube components and a prototype assembly to determine the type of materials needed to withstand high temperature and pressure conditions.

3. Extensive testing of instrument components.

4. Testing to establish the type of shielding that will fulfill the requirements of the reactor.

5. Extensive development and testing to arrive at the design of a compatible fuel loading and unloading machine.

9. The development problems which must be solved as a prerequisite to the successful operations of this reactor concept may be regarded generally as being formidable, but capable of being solved. However, solutions in some cases may not be available at the earliest projected date for startup. The fuel element development problem is substantial and, although it is desirable that a high-integrity fuel element be developed before the reactor begins operation, it would nevertheless be feasible to start reactor operations with the best available element, at some sacrifice in reactor performance. Because of these development problems it is difficult to project a time schedule that would encompass the overall development, final design, and construction period as well as the attainment of design performance after startup. To proceed with final engineering design and construction before acquiring answers to important developmental problems could result in a reactor whose operating characteristics could not achieve target design expectancy, and thus fail to obtain the projected economics of plutonium or power production.

REACTOR SAFETY

10. Relative to the safety characteristics of this reactor concept, the basic physics and engineering design would incorporate major safety improvements as compared with the basic design of the existing Hanford units. In addition, the design of the building housing the reactor would include provision for some confinement of fission products in the event of major fuel element failure. If constructed at a site not isolated from population densities the reactor building design could be altered to provide for housing the unit within a steel sphere, the cost of which would add an estimated 8 to 10 million dollars to the capital costs reflected in later sections of this report.

SPECIFIC CASES

11. From the basic reactor concept, General Electric studied in detail 6 alternate design cases, and from these cases developed 6 additional generalized reactor designs based on the more detailed design studies. The three cases which span the range of conditions covered by the entire case spectrum and to which all subsequent references are made in this report are the following:

Case 1. Plutonium-only production

Capital cost: $126 million.

Design would provide for plutonum production only, utilizing conventional heat exchangers, with no provision for conversion to dual-purpose operation. Heat generated in the reactor is removed in a primary coolant loop; heat from this loop is transferred to raw water from the river in heat exchangers. The heated raw water effluent returns to the river via gravity flow. The pressures in the primary loop are only as high as need be to prevent boiling while carrying away the heat generated. Water in the primary loop is circulated via conventional electric-driven pumps.

Case 2. Plutonium and 300 megawatt electric power production

Capital cost: $198 million.

Design would provide for operation at a high power level for the concurrent production of plutonium in essentially the same quantity as for case 1, and the recovery of 300 megawatts of electric power if operated as a duel-purpose unit; or for operation at a reduced power level and plutonium production rate for the production of 300 megawatts of electric power if operated for power only. Heat exchanger-boilers would be employed to remove the heat from the highly pressurized, high-temperature water leaving the reactor in the primary loop and to generate steam in a secondary loop in which demineralized water is recirculated. Steam generated in the boilers would be routed to turbogenerators to generate 300 megawatts of electricity, and to the steam-driven pumps employed to circulate the pressurized water through the reactor. The steam condensers would be cooled by once-through river water.

Case 3. Plutonium and 700 megawatts electric power production

Capital cost: $256 million.

Design would provide for dual-purpose operation at a reduced power level and plutonium production rate relative to case 1 while concurrently producing

700 megawatts of electric power. The heat removal and steam generation systems would be generally similar to that described for case 2, except for size.

Case 4 (for comparison). Small reactor for the production of plutonium and 300 megawatts electric power

Capital cost: $129 million.

This reactor concept, for which economic data were provided to the Joint Committee on Atomic Energy by the General Electric Co. during hearings in June 1957, is included for comparison purposes. It is essentially a graphite-moderated power-only reactor capable of being operated as a dual-purpose facility for the concurrent production of 300 megawatts of electric power and plutonium in smaller quantities than from any of the alternate reactor cases described above.

12. A large number of variations on these three cases are possible, particularly with respect to: (1) The amount of electric power equipment installed at the time of construction; (2) the provisions made during construction for subsequent installation of initial or additional power-generating equipment; and (3) the timing of such subsequent installation. For example, if a reactor is built for plutonium-only but with built-in provision for subsequent installation of medium amounts of electric power, initial capital cost would be $151 million (as compared with $126 million for case 1); the installation of the generators, etc., would cost about $59 million, bringing the total cost for the plant and auxiliaries to $210 million (as compared to $198 million for the comparable unit, case 2). Similarly, a unit with built-in provisions for conversion to large amounts of electric power would cost $191 million (versus $126 million for case 1), and later installation of power equipment would cost $75 million if done in 1 step, and $83 million if done in 2 steps, making the total costs $266 million or $274 million (versus $256 million for case 3 where all power equipment is installed during initial construction). The effect of delayed installation of power facilities is to increase the total capital cost for the dual-purpose plant. Delay also defers the sale of power, and thereby reduces the total revenue that can be obtained over the useful life of the reactor to defray the capital costs of the power equipment. These economic penalties tend to increase the desirability for installation of power during initial construction, but this desirability must be weighed against the technical problems associated with power recovery (discussed under the section on development) and the large initial capital outlay required for power facilities.

ECONOMICS—GENERAL

13. The economics of the three cases of reactors defined in the preceding section can vary widely, depending on the assumptions used. The location of the reactor, duration of a military requirement for plutonium, value of electric power generated and method of financing all affect the apparent economics of the unit. This study essentially develops the apparent economics of the reactor concepts on the basis of Government financing assuming construction at Hanford. Studies were also made to illustrate the possible economics of this reactor concept at another site, based on Government financing. Finally, possible economics based on private financing, both at Hanford and another site, were examined. The economics at Hanford based on government financing are based on extrapolations of considerable cost experience with construction and operation at that site. For the economics at Hanford based on private financing or for the economics at another site based on private or Government financing, no such experience is available to draw from; accordingly, first approximations of what such costs would be were employed to provide an order-of-magnitude comparison of the alternate cases.

ECONOMICS AT HANFORD

14. Assuming Government financing and reactor construction at Hanford, estimates of capital costs and plutonium unit costs for each of the three cases of reactors defined in the preceding sections of this report as well as for case 4, are summarized in appendix A. This appendix shows what the relative unit costs of plutonium production would be if computed on a full AEC cost basis, as well as on the incremental (out-of-pocket) cost basis. The incremental cost basis accounts only for those additional capital and operating costs that would be incurred at Hanford if an additional reactor of one of these case types were constructed there. This basis, therefore, shows the new out-of-pocket

cost to the AEC of plutonium from the new reactor. In order to consider the economics on the basis on which AEC accounting procedures are founded, it is necessary to show also the full costs. On the full-cost basis the new reactor would bear its pro rata share of overall costs similar to the shares borne by existing reactors at Hanford. For both cost bases, Government costs include:

(*a*) Amortization of capital investment on a straight-line basis.

(*b*) Cost of fuel consumed in the reactor based on current cost of producing enriched U–235.

(*c*) Cost of labor, materials, services, etc., for operation of the facility.

and exclude:

(*a*) Interest on capital investment.

(*b*) Interest on fuel inventory.

(*c*) Costs of process development.

(*d*) Allowances for insurance, taxes, and other costs which must be included in private enterprise financing, including allowance for profit to private investors.

15. Because of uncertainties in the duration of the demand for plutonium, the unit-cost calculations have been based on arbitrary assumptions. One assumption is that plutonium demand wil last for 10 years after reactor startup, until about September 1, 1972, at which time the reactor will be either shut down or be operated for power-only for the remainder of its useful life (taken as 25 years). Using this assumption, the unit cost calculation for case 1, the plutonium-only case, is based on reactor shutdown after the 10-year plutonium demand period and thus the entire capital cost is written off in 10 years. For the dual-purpose cases (cases 2, 3, and 4) the unit costs are the resultant of the total capital cost plus the operating costs for 25 years less revenues from power sales for 25 years less revenues from plutonium credits at $12 per gram for the last 15 years divided by the total quantity of plutonium produced in the first 10 years. An alternate assumption is that the demand for plutonium continues for 25 years after plant startup (until 1987). The unit costs on this basis are the resultant of the total capital cost plus the operating costs for 25 years less power revenues for 25 years (where applicable) divided by the total quantity of plutonium produced during the 25-year period.

16. In the course of evaluating electric power for the Hanford location, discussions were held with the Bonneville Power Authority and the Corps of Engineers and from these discussions it was determined that a value of $25 per kilowatt-year (3.58 mills per kilowatt-hour at 80 percent load factor) would be reasonable for a block of power in the range being considered, if integrated into the BPA system. In the view of the Federal Power Commission (see appended letter) $25 per kilowatt-year is believed to be a reasonable but conservative "at site" value for the Hanford location. Accordingly, in all cases where the reactor is assumed to be located at Hanford, electric power has been evaluated at $25 per kilowatt-year. This value reflects the conditions in the Columbia River Basin area where a large hydroelectric network appears to be capable of absorbing a large block of power. During periods of the year when it is possible to store water in the BPA system, the electric power output of a dual-purpose reactor could be used at high load factor. The hydro system, even in periods of low water, would provide adequate backup for a dual-purpose reactor since water level reduction to produce power during the outage of the nuclear plant could be restored when the plant was placed back in operation. At sites other than Hanford the value of nuclear power would depend on the size and characteristics of the overall power system, the nature of the system load, the dependability of the nuclear powerplant and other factors. A reasonable determination of value would require extensive study for the specific site being considered.

COMPARISON OF CASES

17. Referring to the relative plutonium unit cost information on the full-cost basis shown in appendix A and recognizing that the precision of the derived unit costs is not such that small differences are regarded as significant, it is possible to make the following observations:

(*a*) On the assumption of a 25-year requirement for plutonium (i. e., until about 1987).

(1) The dual-purpose reactor case which produces plutonium at a rate comparable to the single-purpose unit is case 2. The cost of plutonium from the dual-purpose reactor shows a slight advantage over the cost of plutonium from the plutonium-only reactor.

(2) Case 3 operates at the reduced plutonium production rate through all of the 25-year period while concurrently generating 700 megawatts of electrical power. The increased power revenue obtainable with this large generation rate is indicated to result in significant reductions in the cost of plutonium below the single-purpose and 300-megawatt dual-purpose cases.

(3) The cost of plutonium in case 4, included for comparison purposes, is competitive with the single-purpose unit; however, the plutonium production rate is substantially less.

(4) Comparison of cases 3 and 4 reflects the plutonium cost advantage with the larger reactor where the greater productivity results in a one-third reduction in the plutonium unit cost.

(*b*) On the assumption of a 10-year weapons requirement for plutonium (i. e., until 1972).

(1) For comparable plutonium production rates during the 10-year period, comparison may be made between cases 1 and 2. The cost of plutonium from the plutonium-only reactor shows a slight advantage over the dual-purpose reactor, or the reverse of the results reflected from comparison of the economics of these 2 cases based on a 25-year plutonium requirement.

(2) There are, of course, possible offsetting factors which are difficult to evaluate on a strictly economic basis. These include the benefit in terms of operating experience and contributions to power reactor technology that might be realized from generating a large block of nuclear power over an extended period of time even though some minor penalty in plutonium production or economics may be involved.

(3) The dual-purpose reactor showing an advantage over the single-purpose reactor in terms of plutonium cost is case 3 where large amounts of electric power would be produced over all of the 25-year operating period. The plutonium produced for meeting the assumed 10-year demand is significantly reduced in comparison to the case 1 and case 2 reactors.

18. These results indicate that for dual-purpose units of the type studied to reduce significantly the cost of plutonium, power generation rates must be larger than 300 electric megawatts.

ECONOMICS FOR GOVERNMENT OPERATION AT ANOTHER SITE

19. The economics associated with construction of a dual-purpose reactor at a site other than Hanford was studied briefly by General Electric for 2 sample cases, that of the large and small 300-megawatt electric power units (cases 2 and 4). The results of this preliminary review are given in the following summary tabulation:

Cost element	Unit	Large thermal power, 300-megawatt electric power	Small thermal power, 300-megawatt electric power
Capital cost	Millions of dollars	219	134
Unit Pu cost (25 years):			
At 3.58 mills per kilowatt-hour	Percent	107 [1] (117)	103 [1] (113)
At 6.50 mills per kilowatt-hour	do	80 [1] (87)	10 [1] (17)
For comparison: Unit Pu cost (25 years) if at Hanford, at 3.58.	do	100	100

[1] If capital and operating costs exceeded estimates by 10 percent. (See narrative below.)

20. Regarding the estimated capital cost for construction at a new site, a firm estimate could be made only on the basis of a definite location since the cost of land and supporting facilities could be significant factors. In the case of the estimates provided, it has been assumed that the reactor plant would be constructed at an existing AEC site where a complete supporting establishment might be assumed. It is also assumed that fuel-cycle operating costs would be the same as for reactor location at Hanford except for the cost of shipping spent fuel elements to a separations plant. As complete supporting facilities are not available at any of the other AEC sites except perhaps Savannah River, the estimates may be, on the average, low by at least 10 percent. As stated previously, the Hanford site may be uniquely able to absorb a large block of electric power and it may be very difficult to predict what the electric power value from

a dual-purpose reactor might be at an alternate site. The value would depend on the characteristics of the system into which it would be connected, whether adequate backup were available and what the effect on a system of dropping large loads might be. There is doubt that a value as high as the 6.5 mills per kilowatt-hour could be obtained anywhere in the United States and there is a question as to whether even 3.58 mills is realistic for most areas. Since these large blocks of power depend in effect on a single boiler which is subject to sudden outage, it is possible that power from such a reactor might be worth only dump value at sites other than Hanford.

ECONOMICS FOR PRIVATE FINANCING

21. The results of a very preliminary study of the economics of dual-purpose reactor construction and operation by private capital are summarized in the following table:

Cost element	Unit	Large reactor, 300 megawatts electric power		Small reactor, 300 megawatts electric power	
		At Hanford	At another site	At Hanford	At another site
Capital cost	Million dollars	234	241	147	150
Unit Pu cost (25 years):					
At 3.58 mills per kilowatt-hour	Percent	223	380	233	393
At 6.50 mills per kilowatt-hour	do	200	282	210	300
For comparison: Unit Pu cost (25 years) if by Government account at 3.58 mills per kilowatt-hour.	do	100	107–117	100	103–113

While recognizing the possible limited accuracy of the private operation cases, it is still possible to draw general conclusions concerning the attractiveness of a large or small dual-purpose reactor of the Hanford type for private operation. The large capital charge which must be assessed against either type under private operation and the somewhat higher operating costs result in plutonium prices which are doubled or quadrupled over the corresponding Government cases. Even when 6.5 mills per kilowatt-hour power revenues are assumed, the plutonium unit costs are still much higher than those obtained under Government operation.

EFFECT OF DEVELOPMENT PROGRESS ON PRODUCTION AND ECONOMICS

22. Relative to the existing Hanford reactors, the concept of this new reactor involves more advanced technology with respect to the severity of operating conditions; also, the advanced technology required to achieve the new conditions is not yet fully developed. Accordingly, there is a possibility that full power level and performance cannot be achieved, at least at the outset. The effect on the degree to which design performance can be approached without satisfactory solutions to the development problems is different for the various cases. As an example, should it be found that, for any reason, the reactor must operate at lower than design temperatures, the effects on power and production levels would be different for single and dual-purpose types. In cases that do not involve power recovery, operation at lower than design temperatures will restrict the reactor power level, although not as severely as in the cases where steam is generated on the secondary side of the heat exchangers.

SCHEDULES

23. *Development.*—Relative to the development schedules prerequisite to the initiation of final design of any of the alternate cases, the requirements do not preclude initiation of a construction program based on a 4-year completion schedule. This does not, however, constitute a commitment to complete the necessary development work on the time schedule needed to fulfill a 4-year construction schedule from the date of authorization of final engineering design and construction. The items for which greatest need for development exists will affect the level of attainable reactor performance rather than the basic ability to produce plutonium.

24. *Construction.*—In regard to the 4-year schedules for reactor completion from date of authorization, a number of factors will have a significant effect on attainable schedule performance, including contracting policy, procurement experience, and the degree of emphasis given to shortening the schedule at the expense of total project costs. Preliminary study indicates that the schedule will be set by the procurement time required by certain key reactor components and items of engineered equipment. Since these are relatively unique to full-scale reactors of the Hanford type, there are no firm bases available for precise prediction of procurement time requirements; thus, further refinement of this general schedule estimate is not possible at this time.

CONCLUSIONS

25. A variety of conclusions may be drawn relative to the economic attractiveness of the new Hanford reactor concept, whether considered as a single-purpose, plutonium-only facility or as a dual-purpose, plutonium-and-power facility depending on the assumptions made relative to the need for additional plutonium and the duration of such need, the marketability and value of large single blocks of nuclear electric power, and the financial method by which the economics are calculated. Based on the specific set of assumptions used in this report, the following conclusions may be drawn:

(*a*) It is feasible to design and construct a reactor of this concept.

(*b*) Whether the reactor could be operated to achieve or exceed the design production objectives would be dependent upon the solution of a number of difficult development problems.

(*c*) At the target design power level, the reactor built as a plutonium-only unit would produce plutonium in larger quantities and at unit costs lower than those obtainable from any other plutonium-only concept known at this time.

(*d*) If development problems preclude the attainment of design performance in the plutonium-only concept, the penalty may not be severe. Production and cost performance comparable to current experience at Hanford could probably be expected.

(*e*) A dual-purpose concept, generating medium amounts (300 megawatts) of electric power, could produce about as much plutonium as the production-only reactor at the target design level. Based on a power value of 3.58 mills per kilowatt-hour, the contribution of power revenue toward the reduction of plutonium costs is marginal. However, there may be offsetting, intangible benefits.

(*f*) A duel-purpose concept generating large amounts (700 megawatts) of electric power will produce plutonium at a significantly lower cost than a plutonium-only concept. However, the case studied indicates that, at this level of power generation, the rate of plutonium production is reduced significantly and the capital cost of the facility is doubled ($256 million versus $126 million).

(*g*) The penalty for failure to achieve design objectives in the dual-purpose reactor cases would be more severe than for the plutonium-only reactor.

APPENDIX A.—*New production reactor—Summary of selected cases*

Item	Large reactor; plutonium only (case 1)	Large reactor; plutonium plus 300 megawatts electric power (case 2)	Large reactor; plutonium plus 700 megawatts electric power (case 3)	Small reactor; plutonium plus 300 megawatts electric power (case 4)
Capital costs:				
Complete reactor area (millions of dollars)	120	188	245	129
Auxiliary and fuel cycle facilities (millions of dollars)	6	10	11	8
Total (millions of dollars)	126	198	256	137
Plutonium unit cost (after power credit), percent of 10-year, full cost, case 1:				
(*a*) Full cost basis:				
10 years as production unit, then 15 years for power only (percent [1])	100	105	71	129
25 years as production unit (percent)	78	73	49	73
(*b*) Incremental cost basis:				
10 years production unit, then 15 years for power only (percent [1])	88	90	49	110
25 years as production unit (percent)	66	61	34	61

[1] Since the case 1 unit has no capability for electric-power generation, shutdown is assumed at the end of the 10-year period. All of the other units are assumed to operate for an additional 15 years as power reactors. Net income from the power operation is assumed to be used to amortize a portion of the total investment, hence the plutonium cost indices shown include only partial amortization of the total investment.

NOTE.—Power is credited at $25 per kilowatt-year for both production and power-only operating periods; plutonium is credited at fuel value ($12 per gram) during the power-only period.

FEDERAL POWER COMMISSION,
Washington, D. C., February 21, 1958.

E. J. BLOCH,
Director, Division of Production, Atomic Energy Commission,
Washington, D. C.

DEAR MR. BLOCH: This refers to your letter of February 4 requesting our views on the use of a figure of $25 per kilowatt-year as the value of electric power which might be generated by a reactor at Hanford.

In economic analyses of hydroelectric projects it is our practice to measure the value of the potential power output by the cost of power from some alternative equally dependable source. In most sections of the country the alternative source has been a modern steam-electric plant. In the Pacific Northwest, however, other factors had to be considered because of the large blocks of hydroelectric power that were available at costs less than the cost of steam-electric power. Detailed studies were made of the cost of an alternative hydrosteam system, using weighted public and private financing based on the percentages of Federal hydropower estimated to be utilized by publicly and privately owned systems. A recent review of these studies indicated that the regional value of power from Federal hydroelectric projects would be approximately equivalent to the cost of power from public non-Federal steam-electric plants. Accordingly, the latest power value estimated for the Pacific Northwest was derived by utilizing such costs as the measure of the value. This latest estimate was made for the Corps of Engineers, at their request, for use in their review of the report on the Columbia River Basin published as House Document 531, 81st Congress, 2d session. The estimated composite regional value furnished the corps was $15.46 per kilowatt-year of dependable capacity plus 3.32 mills per kilowatt-hour. This estimate was based on July 1, 1957, price levels and represents the value of power delivered to major load centers.

In deriving the above value, costs of steam-electric power were estimated by our San Francisco office for plants at several locations throughout the Pacific Northwest. One of the plants was assumed to be located at Pasco, Wash. The figures of $15.88 per kilowatt-year for capacity plus 4.42 mills per kilowatt-hour for energy mentioned in your letter are the estimated local costs for power that could be produced by a steam-electric plant located at Pasco, with the power delivered 15 miles to the 115-kilovolt regional grid.

The composite regional cost of $15.46 per kilowatt-year plus 3.32 mills per kilowatt-hour derived for the corps includes transmission costs of $1.59 and 0.05 mill, respectively. Thus, the weighted average cost at the site of the steam-electric plants would be $13.87 per kilowatt of dependable capacity plus 3.27 mills per kilowatt-hour. A reactor at Hanford would be at a location comparable to locations selected by our San Francisco office for possible steam-electric plant sites. Therefore, assuming that the power from a nuclear plant at Hanford would be comparable in dependability to the output from a steam-electric plant, its value would be about $13.87 per kilowatt-year plus 3.27 mills per kilowatt-hour, subject to the following qualifications.

The existing power supply in the Pacific Northwest is predominantly hydroelectric and the streamflow characteristics are such that even in adverse years excess water may be available during 5 months of the year. In adverse years the water available during the other 7 months is insufficient to utilize all of the installed hydroelectric capacity. Since the annual load factor in the Pacific Northwest is about 70 percent, any new capacity which can operate in excess of 70 percent annual plant factor would be valuable in firming up some of the hydroelectric capacity during the 7-month period of lower streamflow. On the other hand, the value of energy from a nuclear plant might be reduced considerably during the high streamflow months, because utilization of the high plant factor generation from the nuclear plant might require reduction of an equivalent amount of generation by hydroelectric plants with a resulting additional spillage of water from reservoirs. This is the condition as it exists today and probably will exist for some years in the future.

It is our understanding that a nuclear powerplant would operate at an annual plant factor of at least 80 percent. At that plant factor, and utilizing a value of $13.87 per kilowatt-year for capacity plus 3.27 mills per kilowatt-hour for energy, the total value would be $36.79 per kilowatt-year if a market is available for all of the energy. If it is assumed that the energy would be salable for an average of 7 months each year, the annual value would be $27.24 per kilowatt. These figures do not give any effect to the possible value of the nuclear plant in firming hydroelectric capacity.

Considering all of these factors, I believe that the value of $25 per kilowatt-year proposed in your letter is a reasonable but conservative "at site" value to use in your present report on a Hanford reactor.

Sincerely yours,

FRANCIS L. ADAMS,
Chief, Bureau of Power.

APPENDIX 4

SPEECH BEFORE ATOMIC ENERGY MANAGEMENT CONFERENCE OF ATOMIC INDUSTRIAL FORUM AND NATIONAL INDUSTRIAL CONFERENCE BOARD, CHICAGO, ILL., WEDNESDAY, MARCH 19, 1958, AT 12:30 P. M.

By Hon. Carl T. Durham, Chairman, Joint Committee on Atomic Energy

CURRENT PROBLEMS IN ATOMIC POWER DEVELOPMENT

It is a pleasure to talk once again to members and guests of the Atomic Industrial Forum and the National Industrial Conference Board at this joint luncheon. I use the phrase "once again" advisedly since I talked to the forum at your New York meeting last fall, and to the NICB at your Philadelphia congress last year.

Today I propose to discuss some of our current problems in atomic energy development, both the military and peacetime aspects. These problems for the most part have been disclosed by the Joint Committee hearings this session, by its informal seminars on the atomic power program held last fall, and by its trips to atomic installations here and abroad. Because of your interest in questions of management and in formation, I have tried to emphasize these aspects of the issues of public policy which I discuss.

In a sense my talk today may be said to be a followup on my Philadelphia speech of a year ago. In that address I reviewed some of the hard facts in the atomic-energy field, and attempted to point up some the hard questions which are necessary to an understanding and solution to the problems which face us. I also made some recommendations as to policies and programs which

I believe are necessary to meet our national and international obligations in the atomic-energy field.

BASIC QUESTIONS

I believe we have made considerable progress in recognizing most of the facts and hard questions to which I called your attention last year. For example, the problems of increased costs and slippages in schedules of prototype reactor projects, together with the basic questions of where the money and direction for an expanded program are going to come from, have received considerable attention in the past year.

I regret to say that we are still not out of the woods in terms of revised policies and expanded programs necessary to cope with the situation. The root problem is the question of leadership in atomic technology, and the role of the United States and the AEC in assuming such leadership.

However, I still remain an optimist as to how it will all come out. I am particularly pleased that AEC, with the active participation of its new Commissioners, shows signs of assuming some of the qualities of leadership and a willingness to cooperate with the Congress, which are so necessary to the success of any program.

MILITARY APPLICATION PROBLEMS

Getting down to cases, let me first review some of our problems in the military field. To begin with, let me point out that we continue to make improvements in weapons technology. Our weapons development and production has been in advance of their means of delivery, particularly as to missiles. There has been no lag in the atomic warhead phase of the missile program.

Civilian control

Last year I pointed out that most of our progress under the 1946 and 1954 Atomic Energy Acts is attributable to the fact that we have had a civilian Atomic Energy Commission responsible for the entire atomic energy program.

This policy of civilian control is presently being put in jeopardy in two different ways. First is by the process of nibbling—of proposing detailed changes in the Atomic Energy Act and practices thereunder which may enhance the role of the military. For example, in H. R. 10348, which provides for exchange of information and materials with our NATO allies, there is an obscure provision which extends a Defense Department veto over the declassification of restricted data from weapons to all military applications, including naval reactors, and nuclear aircraft and rocket development conducted by the AEC.

Outer space propulsion

More important, we are also faced with serious challenge to civilian control in the field of outer space propulsion. Hearings held by the Joint Committee revealed atomic energy will play a key role in long-range spaceships with heavy payloads. The atom will be important both as a heat source for the initial thrust, and as a source of electrical power to accelerate possible ion propellents once a ship reaches outer space.

But as recent events have shown, the combination of the Defense Department and the promoters of conventional fuels and aircraft is making a strong play for military development of space vehicles. I recognize that there are reasonable arguments for and against giving the complete responsibility to AEC along the lines of S. 3117 and H. R. 10271 introduced by Senator Anderson and myself. However, I do believe we must remain true to the principle of civilian control and, as a minimum, preserve AEC responsibilities for atomic power development for space vehicles.

Plutonium production bottleneck

Our second problem in the military field concerns our needs over the next 5 or 6 years for additional amounts of plutonium for an expanded small weapons program. I regret to say that the Defense Department has made no progress in getting out of its bureaucratic treadmill of basing its plutonium requirements on current AEC productive capacity. This absurd situation has been repeatedly called to the attention of the military since the first Joint Committee meeting was held on the subject in 1947. I hope the new Secretary of Defense will substantially revise his planning procedures in time for his first appearance with the Joint Committee in the next month. Meanwhile, we are looking forward to the design study for an advanced large-scale plutonium-producing reactor which the Joint Committee authorized last year.

Aircraft nuclear propulsion project

Our third and last problem in the military field relates to the aircraft nuclear plopulsion project, or ANP as it is called. Plans for the so-called early flight program received a serious setback by the Under Secretary of Defense and the President on March 5 of this year. For a while last year and early this year, we thought the ANP program was getting on the right track. Management improvements in terms of placing responsibility for the ANP program in a single office under the direction of one man—so long recommended by the Joint Committee—were finally accomplished.

The project was even able to get by several advisory committees and an Assistant Secretary of Defense for Research and Engineering, now retired. But it came a cropper with another committee, or subcommittee, appointed by Dr. Killian. This committee, after only an afternoon's briefing and a cursory field trip, made its recommendation to the President and Defense Department without even discussing its tentative findings with the officials responsible for the technical direction of the work. In the Joint Committee's hearing on March 5, it was brought out that a full year has been lost in the shuffle of schedules as presented to the committee a year ago. Thus the ANP program remains as a colossal monument of maladministration by the Defense Department.

Naval reactor progress

We can retain some pride that in the field of naval reactors we continue to make progress under the leadership of Admiral Rickover and the AEC Naval Reactors Branch. During the past year the *Nautilus* accomplished its daring Arctic exploration under the polar ice, and the new and most modern atomic submarine, the *Skate*, set a record on its first run to England. Our main problem with respect to nuclear submarines is how to get more of them, particularly the type from which the Polaris or other intermediate range missiles can be launched.

PEACETIME APPLICATIONS OF ATOMIC ENERGY

Coming now to peaceful applications of the atom, we can point to considerable accomplishment in the last year. The diversified types of experimental reactors in the AEC 5-year program sponsored by the Joint Committee reached criticality and began low power operations. Our first full scale atomic powerplant at Shippingport also went into operation in 1957 and continues full power operations. Progress is being made in some of the private reactor projects, such as the Vallecitos experimental reactor, and the Dresden project near this city of Chicago.

During the past year in the foreign field, the International Atomic Energy Agency was established and the treaty ratified. As you know, our former colleague, Stub Cole, is Director General of this agency, and Bob McKinney whom you heard last night, is the senior United States representative. The new Euratom atomic power agency has also been established, and the AEC has announced that a cooperative program is being developed.

Declassification

Progress is also being made in other aspects of the atomic energy program. AEC reports that continued emphasis is being given to declassification of civilian reactor technology. Possibly more important has been the declassification of many phases of the controlled thermonuclear project.

Reference to the Sherwood project reminds me of a colloquy during the 202 hearings a few weeks ago. Representatives of the Commission were pointing out how liberal they were in declassifying parts of this project. At this point, I asked the question which has troubled me for some years: "Why don't you declassify the entire controlled thermonuclear project?" Various reasons were given as to why this would be bad, including the problem of a backlog of unpublished information which would require 2 years to untangle. The latter reasoning points up dangers to research efforts carried out under secrecy wraps, and raises the further question whether the program should ever have been classified.

Certainly, with the Russians probably at a comparable stage of development in controlled thermonuclear research, the Commission ought to ease up on the present stringent criteria blocking widespread industrial access to information being developed in the program. Continued exclusion of competent American industrial firms and their engineering talents from this important work will not

only fail to serve national security interests but will penalize us in our efforts to compete effectively with the Soviet-bloc nations in scientific advancement.

The overall problem of security classifications may need some rethinking in the light of Under Secretary Quarles' statement before the Joint Committee as to the independent progress achieved by the Russians in their weapons program as follows:

"We believe that there are no important areas of nuclear weapon technology known to the United States that the Soviets will not be able to attain through their own efforts.

"We believe this competence has been achieved in a large measure independently of outside sources of information."

Undoubtedly the technical accomplishments of the Russians, apparently unaided by United States developments, will ultimately require a complete reappraisal of our classification and security policies.

Industry consultation

Improvements have also been made during the year in AEC's policy of consultation with industry as a group. Heretofore AEC had followed this policy only with respect to its licensing program, with generally good results. With some encouragement from the Joint Committee, AEC has extended this policy to its indemnity program and then to its reactor development program last December. More recently the Commission has indicated a possible willingness to undertake group consultation on its contract policies. A first step was taken in a recent informal seminar held by the Atomic Forum. The Commission is also undertaking group consultation on its patent policies through a series of public hearings.

Patents

Incidentally, the question of patents also received some consideration during the 202 hearings. The committee was informed once again that AEC is not making an extensive enough effort to protect United States patent rights in foreign countries, to the detriment of all industry in the United States and particularly the industrial contractor which did the development work on which the patent was based. Problems of compulsory cross-licensing of private inventions under the Atomic Energy Act of 1954 were also discussed in the statutory hearings.

Bureau of Budget holdbacks of funds

Possibly the greatest single problem encountered by AEC since Congress adjourned last August—with the exception of the raw materials cutback, and expanded atomic power program—was the problem of the holdback of funds for AEC authorized projects which the Congress had appropriated. When members of the Joint Committee returned from their trip to Vienna and European atomic energy installations last fall, we naturally began to inquire how the program Congress had authorized was coming along. To our surprise, we found that many projects had either been delayed substantially or not started at all. Thus, for example, we found that all funds for construction of the EBR II had been held up, and that no construction funds for the plutonium recycle reactor project had been made available.

In view of these apparent unnecessary delays, I wrote a letter to the Commission dated November 7, 1957, requesting complete information as to the holdbacks, and inquiring as to what efforts AEC was making to get the money. It has taken a series of letters and conferences with the AEC Controller's office over a period of several months to get all the facts. In summary it appears that of December 1, 1957, a total of $360,656,000 in construction appropriations were held back. Analysis of individual cases revealed that AEC was not always diligent in trying to obtain its funds from the Bureau. However the procedure adopted by the Bureau of requiring rejustification of budget requirements each month on an urgent project basis made it extremely difficult for contractors and AEC administrators to come through with the necessary back-up each month. It was only after repeated inquiry by the Joint Committee that action on releasing these funds was begun in December and January of 1958.

From the above discussion, you can see that we on the Joint Committee were gratified, but not impressed, by a series of AEC announcements in the last month or so about the authorization of design of a large-scale accelerator, and a fuels technology center, at Argonne. They were authorized a long time ago, but false economy and poor management by the executive branch had held them up all the time.

Civilian atomic power program

Now if the AEC's Government atomic power development program could be said to have been stalled for lack of funds last fall, the Commission's power demonstration program and the private atomic power development program perhaps could be said to have been "marking time," possibly for the same reason.

As you will recall, there appeared to be considerable confusion as to what the objectives of the program were and should be, and what kind of a program was needed to implement various assumed objectives. Various responsible groups, such as the Atomic Industrial Forum, the American Assembly of Columbia University, and the National Planning Association, pointed out the seriousness of the situation and the necessity for arriving at some solution as to objectives, program, and methods.

The Joint Committee on Atomic Energy, as the congressional "board of directors" for the Nation's atomic-energy program, has long felt the need for positive and vigorous action in our atomic-power-development program. In view of the confusion over the existing program and its objectives, the committee convened a series of informal seminars this past November to consider the views of reactor experts and representatives of the atomic industry.

The results of these seminars confirmed the committee's belief that greater efforts will be needed to spur a program which is still very much in the research and development stage. The results also tended to confirm the impression that there is no present general shortage of engineers and scientists and that the main roadblocks are technical and financial.

It was in this context that I wrote a letter to Chairman Lewis Strauss, of the Atomic Energy Commission, on November 27, 1957, requesting the Commission to develop, with the cooperation of the Joint Committee, some realistic program objective and an accelerated program to carry them out. The Commission accepted this invitation, and considerable progress has been made toward a definition of objectives. Progress has also been made on the scope of the program, but there are outstanding questions as to methods of getting the job done which must be resolved.

While it obviously is not possible or appropriate to reveal the details of what the Forum Memo has called Suspense in Washington, I believe it is in the public interest to sketch the program objectives which have been discussed and to which no serious disagreement has been raised. These objectives may be summarized as follows:

(1) To achieve economic atomic power in the United States at early date.

(2) To render maximum help to our foreign friends, particularly our NATO allies, in their program to achieve nuclear power in large quantities as soon as possible.

(3) To fortify our worldwide leadership in the peaceful applications of atomic energy, particularly atomic power.

(4) To obtain more plutonium.

As you can see, they are pretty much the same ones that we all have been talking about for some time. But it does do some good to get them down on paper, and then begin to set target dates, and monetary levels of effort. Then we have to scope it out and figure out the methods of financing and direction.

But no matter what methods are adopted, we can be sure that any expanded program will take substantially more funds, Government and private, and a great deal of effort by all participating organizations.

This raises the final question of whether it is worth it. I think such an accelerated atomic power program is at least as important as building post offices and levee projects ahead of schedule to combat the recession. In this connection we should note that reactors and laboratories and reprocessing facilities use a great deal of concrete and steel.

But far more important, it seems to me, is our obligation to ourselves and the free world to maintain our world leadership in atomic technology. We all know that the Soviet Communists are engaged in an all-out effort to beat the United States in science and technology, including atomic energy. History has shown that when a nation starts on the downgrade in its leadership, as measured in the development of its energy resources, it usually loses out as a world power. I don't think we want that to happen here.

I would like to emphasize that the program which I hope we can come up with will be one which provides for a cooperative effort with rather than an all out competitive effort against, our friends and allies in Britain and the North Atlantic countries represented in EURATOM and the OEEC. In cooperating

with them, we help our own atomic equipment industry get some experience in building reactors.

In conclusion, I should like to point out that we have time enough—but with precious little to spare—to come up with an adequate atomic power program in this Congress. I believe that the AEC in good faith is trying to develop a workable program which will be acceptable to all concerned. If despite these efforts, for reasons of fiscal policy or otherwise, the Commission is not able to come up with an adequate program, then the Joint Committee and the Congress must try to fill the gaps.

Well, gentlemen, that about completes my sketch of some of our current problems in atomic energy development. I couldn't cover them all, such as the raw materials problem, but I hope you may have obtained some insights on the way our mutual problems are viewed from Capitol Hill.

Thank you very much.

APPENDIX 5

ADDRESS OF SENATOR CLINTON P. ANDERSON (DEMOCRAT, NEW MEXICO), VICE CHAIRMAN, JOINT COMMITTEE ON ATOMIC ENERGY, AT FOURTH ANNUAL MEETING NUCLEAR ENERGY WRITERS ASSOCIATION, NEW YORK, N. Y., JUNE 18, 1958

A PATTERN FOR ATOMIC POWER

You were kind to extend to me an invitation to be guest speaker at the fourth annual banquet of the Nuclear Energy Writers Association.

I believe the last representative of the Joint Committee to speak before you was my friend, Carl T. Durham, the current chairman of our committee. As you will recall at your meeting in February of 1957, he outlined four functions of the Joint Committee, namely, legislative, investigative, policymaking, and informational.

At a recent meeting of the Washington Press Club, my talk dealt with two of these functions, namely, the investigative and policyforming roles of the Joint Committee. This was in connection with the plutonium supply problem. This would be no time to repeat what I then said but we should not let the press of other items persuade us to forget that in September of 1956, in August of 1957, and on May 9, 1958, the Joint Chiefs of Staff have recommended that additional supplies of plutonium be made available—and up to this hour, nothing gets done.

Tonight I want to continue with some consideration of our policy functions and also touch on our informational role. I regret that neither the chairman nor other members of the committee, including myself, could attend your meeting last fall. But from what I heard afterward, perhaps it was just as well. The country was in a fit of anxiety with the Soviet sputniks. And the atomic power industry was in the depths of gloom as to its status and prospects. It was becoming apparent that the so-called "firm" orders for atomic powerplants, such as in Latin America Italy, and Japan, were no better than the paper of the press releases on which they were written. The situation was as bad domestically with not a single atomic powerplant ordered up to that time in 1957.

All the atomic industry was receiving from the AEC at that time was the same old pap that everything was all right, and that anyone who recommended greater Government support of atomic power development was a "socialist" or public-power advocate. On the other hand members of the Joint Committee were upset that there needed to be a wrangle over the safety of the Detroit Edison project, and over the unsuccessful attempts of the committee to accelerate the atomic power program.

It was not unexpected that some of this controversy would rub off on you writers. And, as I say, it is just as well I wasn't there. For I probably would have said, "I told you so." And I also probably would have said that things might get worse before they got better.

Tonight we can all be pleased that it now appears we may be able to look over the hump, even if we may not be quite over it. In several ways which are above and beyond changes in personnel, we have made progress since last fall. Thus during the last 6 months the technical results of the 5-year experimental reactor program sponsored by the Joint Committee were increasingly beginning to be felt. Results from the Argonne boiling water experimental reactor have looked promising, the organic moderated experiment has been showing favorable results, and the Shippingport atomic powerplant—our first full-scale project—went into operation without a hitch.

Out of the soul searching of last fall has also emerged a better diagnosis of our ills. The reports by the American Assembly, and the National Planning Association, the surveys by Nucleonics and the Atomic Forum, and the seminars by the Joint Committee and AEC, all helped reveal what ails the industry.

The results of these surveys all indicated what a friend of mine always attributed to fishing. When things got rough he would say that there was nothing wrong with him that a big fish wouldn't cure. It could be that while costs of current from atomic plants still seem to be sky high, there may be nothing wrong with the atomic power industry that a few big orders wouldn't cure. The more we build, the quicker we will learn.

Thus our big problem is volume. Or putting it in more academic terms, the findings of the surveys and seminars were that the problems were primarily technical and financial, that is to say that it was not possible to jump from a reactor experiment to a large-scale demonstration of economic power. Rather it was concluded that it will be necessary to support several "generations" of intermediate and full-scale reactors of the same type before the economic value of the reactor concept can be determined.

Since the headshaking of last fall several other factors affecting the industry have also become manifest. The first is that the projects have taken on more of a research and development character, with the building of plants of a first generation type and of an intermediate or small size. Second is that the number of new projects has fallen almost to nothing.

The pattern that has emerged here in the United States in the past year is in marked contrast to that which is occurring abroad. In England in their expanded program, they are constructing large-scale reactors of up to 250,000 kilowatts per reactor and 500,000 kilowatts per station. In Soviet Russia they are also apparently constructing large reactors up to 200,000 kilowatts per reactor and 400,000 kilowatts per station.

We have, I am sure, made some progress since last fall in coming up with remedies for our ills. As you know, Chairman Durham initiated a series of informal discussions with the AEC to develop mutually acceptable objectives and a program to carry them out. In all, four meetings were held between the committee members and Commissioners, and about a dozen meetings more between the AEC General Manager and our Executive Director plus their respective staffs.

The results of these discussions were revealed, in part, in the recent hearings held by Chairman Chet Holifield of our Legislative Subcommittee. As you know, AEC stated some fairly firm objectives for the program, on which there can be little argument. These were as follows:

1. To achieve economic power in this country in 10 years.
2. To achieve economic power abroad in 5 years.
3. To fortify United States leadership in atomic power development.

The Commission also outlined a broad technical program, including a number of reactor prototypes and full-scale reactors for development and construction in the period 1959–63.

All things considered the AEC long-term program statement represented a genuine step forward, and attempted to be responsive to suggestions by the Joint Committee. But the Joint Committee quickly found that the program has significant limitations. For example, AEC has the right to discuss but not the right to determine. Overriding authority is still with the Bureau of the Budget and after the AEC had discussed favorably—I do not say agreed upon because the discussions were always regarded as tentative—various projects, the Bureau of the Budget cut them out from the authorization request for fiscal 1959. Moreover, the statement did not contain any measure of the monetary level of effort contemplated for the program for the 5-year period. Finally the program merely provided for a continuation of another round of the power reactor demonstration program, though it indicated that under some circumstances the AEC might construct experimental prototypes and other reactors where private industry did not do so.

It is unfortunate that the Joint Committee did not have an opportunity to finish its discussions with AEC on the long-term program and particularly the policies on the power reactor demonstration program. Most of the discussions were concerned with the 1959 facility projects, the plutonium buyback policy, and Euratom. In any event, I hope and understand that these discussions will be resumed.

Indeed it is my hope that out of these continued discussions may come a genuine pattern for atomic power development which the AEC can sponsor and

the Joint Committee can support. In my opinion many of the ingredients are already in the AEC program statement.

However, in accordance with our tradition the Joint Committee also wishes to make its own contribution as it did in the hydrogen bomb development. To that end, the staff was instructed to prepare a draft report based on its discussions with AEC, and also to secure the informal advice of a representative panel of reactor experts and industrial engineers. For this purpose the following representatives participated:

Dr. Walter H. Zinn, president, General Nuclear Engineering Corp.
Dr. Henry de Wolf Smythe, chairman, Board of Scientific and Engineer Research, Princeton University.
Dr. Chauncey Starr, president, American Nuclear Society, and vice president, Atomics International.
Mr. Titus LeClair, manager, research and development, Commonwealth Edison Co.
Mr. James Grahl, director, atomic energy service, American Public Power Association.

Based in part on this distinguished assistance, I feel sure that the Joint Committee can work cooperatively with the AEC in coming up with a mutually acceptable program.

One of the things the Joint Committee can contribute to the program statement is an analysis of some of the problems besetting the industry. AEC understandably did not exactly stress how it got into its current fix. I believe confession is good for the soul, and hope AEC will agree.

Another thing that the committee can suggest is a more definitive statement of reactor projects for design and construction in the next 5 to 7 years. It is rather remarkable that there is really little disagreement as to the projects which should be undertaken in any expanded program. Thus one has only to compare the Joint Committee report of 2 years ago with the task force report of the Edison Institute, and the AEC statement of June 4. I have attached an appendix to this speech which bears a resemblance to them all, and which just might be what the Joint Committee is considering.

The scope of the expanded program, as described in the appendix would include about 21 reactors of diversified types, including 9 of large size, 4 of intermediate size, 3 of small size and 5 reactor experiments. It is expected that only about a half of the 21 projects would actually be constructed after design and feasibility studies are completed.

One would think that the disagreements might come as to the scale and pace of effort. But that was not the case in our original discussions with AEC which were held before action by the Bureau of the Budget. It is interesting that our panel of advisers confirmed the level of effort which we had originally discussed with AEC. In each case the method used for calculating the amount was different, but the level came out roughly the same.

Our estimates show total expenditure of about $875 million of capital and operating funds would be needed for the expanded program for 5 to 7 years. This would average $125 million per year over 7 years. In addition there would be the $100 million annual base program. Thus the total civilian program would cost approximately $1,300 million to $1,500 million over a 5 to 7 year period. This is truly atoms for peace at home and abroad and is not very much when one takes into account the billions spent on the military. It would cost less than trying to send a manned space vehicle to the moon, and, I believe, would win us far more in world interest and esteem.

A further matter to which the Joint Committee is addressing itself are the policies of the power reactor demonstration program. Congressman Holifield in his opening statement on June 4, called attention to the need for positive AEC direction of this program. Instead of the current "laissez faire" system whereby AEC remains "willing to consider any proposal" for a plant, and then haggles for the next 2 years, the Joint Committee has suggested that AEC designate the specific project it intends to support. AEC would be expected to obtain prompt proposals for detailed design and construction of the project, and if a bonafide and satisfactory proposal was not received or negotiated, then AEC would proceed with construction under contract. If you seek a program which moves, that will do it.

In addition to constructing plants which private industry does not want to build, some of us on the Joint Committee also consider it appropriate to authorize AEC to construct first generation experimental prototypes without necessarily

going through the laborious process of soliciting proposals, waiting for turndowns. The gas-cooled reactor is a case in point.

As well as providing suggestions on policy and program, the Joint Committee may also point out the need for somewhat less definable ingredients in the program. One of these is imagination. An example is the process steam reactor problem. The Joint Committee expressed interest in this type of development several years ago. AEC in response to questioning indicated mild interest in the subject. But to date AEC has not even carried on a feasibility or design study, nor considered the economics of specific applications. It could well turn out that the types of assistance required for process steam reactors are different than for the electric power reactors.

Of course, imagination may be carried too far. I have reference to speculation on the generation of power based on the heating of rocks from underground explosions. The Rainier underground test threw cold water on this concept. Considerable imagination was also required in getting up AEC's list of reactors constructed, planned, and dreamed about, which has been trotted out each year.

A further, and more important characteristic needed for an accelerated atomic power program is both drive and determination on the part of the AEC to see that the objectives we all agree upon are carried out successfully. This will be a difficult task initially in view of the changes in personnel. But it is not insurmountable, if the will to accomplish it is present.

However, with all the necessary drive and determination in the world, it still may not be possible to come up with a "realistic and well balanced" atomic power program which the Joint Committee called for. The program may never get off the ground because the amount and types of financial assistance provided for under the power demonstration program are simply not enough for private groups and public organizations to make a go of it. The gap between the cost of a conventional plant and a nuclear one may still be too large to be bridged by research and development assistance alone. If so, we should face up to that reality and find the means to do what needs doing.

AEC for its own reasons has not faced up to this fact except in relation to the original plutonium buy-back proposal. The Joint Committee raised the question of other possible assistance in lieu of the buy-back. But AEC to date has not indicated a serious interest in discussing alternatives.

As a means of encouraging consideration of possible solutions to our dilemma, I would like to suggest one alternative which follows along the lines of some of our discussions of last year. Why shouldn't we encourage private and Government plants in the manner best suited to get reactors built and operated for research and development purposes? This would mean some sort of a capital subsidy to private operators, and an extension of the second round for public and co-op owned systems. To this end we might consider application of some sort of an equitable ratio of support to private and public plants in a manner which will promote research and development.

More specifically my proposal would work something like this:

1. This demonstration program would apply only to "second generation" of reactor projects designed by AEC from the approved list of desirable projects for the period 1959–63;

2. Assistance to private groups would not only include research and development assistance and waiver of use charges as presently provided under the third round, but also include a contribution in the form of a grant of perhaps not to exceed 90 percent of the estimated difference between the cost of the nuclear plant and a conventional plant of the same output.

3. Assistance to public and cooperative power organizations would follow along the lines established by AEC in the second round, with the AEC responsible for construction and ownership of the reactor and the public body responsible for construction of the turbogenerating facilities and eventual operation of the entire plant. AEC would provide steam from the Government reactor to the public body at the cost of conventional steam from a comparable fuel-fired plant. This in simple terms is the Elk River, Piqua (Ohio), and Nebraska Public Power formula.

4. AEC financial assistance would be made on an equitable proportion as between private and public organizations in a manner so as to promote design and construction of second generation plants. One suggestion which might be considered was made by Willis Gale, of Commonwealth Edison, last year which would apply a 4 to 1 ratio which is the current proportion of private to public and

cooperative owned plants for the production of electric power by conventional means.

5. All technical and financial information, and patents, would be for the benefit of the public and industry generally, as provided under the current power reactor demonstration program.

It should be understood that experimental prototype reactors would still be constructed by the Government under contract with private industry.

I believe a program along the above lines would go a long way toward ending the stalemate which presently exists. As you know, I have always throught the so-called public power question was a phony in the atomic energy field. Our purpose is and has been to get reactors developed, built, and operating, so that some day in the not too distant future atomic power will supplement conventional energy resources. At that time, the question of private versus public power may be relevant, but anything we do in the next few years will have little real effect when reactors can be bought off the shelf.

In order for a program such as I have envisaged to work properly, there must be a considerable amount of good faith involved. The good faith must exist between AEC and the Congress, and between the participating industrial and utility groups.

In the past, there have been some questions as to the good faith of the executive branch and private organizations in this regard. This became manifest in the Dixon-Yates affair. Some of us have also wondered since whether private power organizations were not more interested in "staking out" the atomic power field for private development than in the early achievement of economic nuclear power.

I am willing to let the dead past bury its dead, and go on to happier days. There is certainly a need for a new era in atomic power development. I hope that this modest proposal which I have advanced will be studied during the next months, and that by the time the next Congress convenes, we will be far enough along to consider it and other legislative alternatives necessary to give the program a real push. In the meantime we should deal with 1959 projects as expeditiously as possible.

It would be pleasing, indeed, if what I have described to you may be said to be at least the outline of a "pattern for atomic power development." In attempts to steer private and public groups into the design and construction of second and third generation atomic powerplants by means calculated to encourage prompt construction without any controversy over public versus private power. Only as we quit our quarrels may we achieve the volume of development and manufacture of reactors and components so necessary for economic power. My proposal also tries to make clear that the role of the Federal Government is primarily that of providing the necessary program of research and development in the design and construction of reactor experiments and experimental prototypes and, if necessary, to fill gaps not otherwise provided for by private industry.

When the victors of World War II were meeting one day at Tehran, General Marshall praised the heroism of the Russian Army.

Stalin replied: "We don't see it that way. It takes a very brave man to be a coward in the Russian Army."

I agree in advance that some new vision may be needed on both sides of the recent atomic energy battles if this Nation is to make available to its industry—nearly all private—and its electric energy distributors—4 private and 1 public—the additional financial support, the extra drive and the enduring good faith required to achieve success for an accelerated program. But it can be done, and if the men who write the atomic news will stand fast, it will take a very brave man to be afraid to try.

[Attachment to address of Senator Clinton P. Anderson at fourth annual meeting, Nuclear Energy Writers Association, New York City, N. Y., June 18, 1958]

LIST OF REACTOR PROJECTS CONSIDERED BY JOINT COMMITTEE ON ATOMIC ENERGY

The program in pursuit of the stated objectives must continue to provide for the exploration of a considerable number of reactor concepts for the purpose of determining which one or ones hold the most promise for economic nuclear power and are, at the same time, reliable and safe. It is also recognized that the program must include the building of a number of experimental reactors, including several generations of nuclear powerplants of the same type but of successively improved designs. The success of the program will depend upon continuing a

broad base effort of research and development and upon providing reasonable assurance that the number of plants built during the next 5 to 7 years will be adequate to reach the program's objectives. The selection of experimental or prototype nuclear powerplant projects will be based upon (*a*) having sufficient technology to proceed, and (*b*) judgment that the reactor-type represented has sufficient economic promise to be capable of meeting the program objectives.

It should be recognized that specific projections of desirable projects within the program become less firm as time is extended. Program flexibility is essential in order to permit adjustments based on technological advances. The program must be subject to constant review to make certain new concepts are evaluated rapidly and projects proved not feasible are weeded out.

Table I lists, in rough chronological order, new reactor projects to be designed during the next 5 to 7 years. It is expected information gained during the design stage will indicate only about half of these projects will show enough technical and economic potential to warrant construction. Second generation reactors are scheduled so design and construction experience in the first generation reactor can be applied to the design of the second. While operating experience concerning high fuel burnup tests, maintenance and high plant factor reliability normally will not be available in time for the next succeeding generation, considerable testing and startup experience should be available and usable.

TABLE I.—*Power reactors for new undertakings*

Project	Approximate electrical rating (megawatt)	Status	Approximate time interval for project
Heavy water cooled and moderated power components reactor.	0 (60 thermal megawatts).	Under study by contract with AEC.	1956–60
Gas-cooled, graphite-moderated	40	do	1958–62
Boiling water with nuclear superheat	10 to 50	Proposal made to AEC	1958–62
Heavy water cooled and moderated	100 to 250	Under study by contract with AEC.	1958–63
Aqueous homogeneous solution	75 to 150		1959–65
Process heat reactor	0 (45 thermal megawatts).		1959–62
Fused salt-fueled	10		1959–64
Steam-cooled, heavy water moderated	10		1959–65
Intermediate energy neutron breeder	10	Under study by Southwest Atomic Energy Associates.	1958–67
Water-cooled-graphite moderated, Hanford-type.	300 to 700	Under study by contract with AEC.	1958–63
Pressurized water, enriched uranium fuel	200		1959–64
Boiling water, enriched uranium fuel	200		1960–65
Organic cooled, organic moderated	50		1960–64
Liquid metal fueled reactor experiment	0 (5 thermal megawatts).		1959–63
2 small second generation industrial plants	15 to 40		1961–65
High temperature gas-cooled, graphite or heavy water-moderated.	200		1961–66
High temperature sodium-cooled graphite or heavy water-moderated.	200		1961–66
Organic-cooled, organic moderated	200		1962–67
Sodium-cooled fast or intermediate breeder	200		1963–68
Liquid metal fueled reactor	50		1963–68

APPENDIX 6

CORRESPONDENCE CONCERNING PLUTONIUM PURCHASES AND "BUY BACK" PRICES

ATOMIC ENERGY COMMISSION,
Washington, D. C., June 3, 1958.

Mr. JAMES T. RAMEY,
Executive Director, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. RAMEY: In connection with our past discussions concerning the matter of plutonium purchases, I understand that Commissioner Vance also discussed this matter with Mr. Durham. Also, that Mr. Durham asked that copies of possible legislation on sections 55 and 56 be furnished for his information.

Enclosed for Mr. Durham are copies of draft legislation which I understand are the same as those covered in General Fields' last discussion with you.

It should be noted that section 55 in conjunction with the prices to be established under section 56, would permit, under current established prices for uranium enriched in U–235, the purchase of plutonium for unrestricted use at a maximum price of $16.12 per gram of metal, and for restricted use at a fuel value that could not exceed $12 per gram of metal. This arrangement would also permit the exchange of 1 gram of U–235 at 20 percent for 1 gram of plutonium provided it was made available for unrestricted use. In addition, it would establish a maximum price for U–233 nitrate at $15 per gram which is the same as the currently established price. Also, that the maximum ceiling prices to be paid for plutonium metal or U–233 nitrate are tied to the established charges for uranium enriched in U–235.

Yours very truly,

R. W. COOK,
Acting General Manager.

DRAFT

SEC. 55. ACQUISITION.—The Commission is authorized to purchase or otherwise acquire outside the United States any special nuclear material or any interest therein under an agreement for cooperation made in accordance with section 123: *Provided*, That neither plutonium nor uranium 233 nor any interest therein shall be acquired under this section in excess of the total quantities authorized by Congress.

a. Any contract hereafter made under the provisions of this section to acquire plutonium or uranium 233 or any interest therein for use as fuel in a nuclear reactor, or in research and development or peaceful applications of these materials may be at such price and for such period of time as the Commission may deem necessary: *Provided*, That no such contract shall be for a period greater than ten years of operation of the reactor or reactors which are or will be producing the material being acquired: *And provided further*, That no such contract shall provide for compensation or the payment of a purchase price for the plutonium or uranium 233 which is in excess of the price established for that material as fuel in a nuclear reactor as determined by the Commission pursuant to section 56 for the year in which delivery is made to the United States.

b. Any contract hereafter made under the provisions of this section to acquire plutonium or uranium 233 or any interest therein for unrestricted use by the United States may be at such price and for such period of time as the Commission may deem necessary: *Provided*, That no such contract shall be for a period of time extending beyond the period of time for which an unrestricted use price has been determined and guaranteed by the Commission pursuant to section 56: *And provided further*, That no such contract shall provide for compensation or the payment of a purchase price in excess of the guaranteed price for unrestricted use established pursuant to section 56 for the year in which delivery is made to the United States.

c. Any contract made under the provisions of this section to acquire uranium enriched in the isotope uranium 235 may be at such price and for such period of time as the Commission may deem necessary: *Provided*, That no such contract shall be for a period of time extending beyond the terminal date of the agreement for cooperation made in accordance with section 123 with the nation or group of nations from which such material is to be acquired: *And provided further*, That no such contract shall provide for compensation or the payment of a purchase price in excess of the Commission's established charges for that material in effect for the year in which delivery is made to the United States.

d. Any contract made under this section for the purchase or exchange of special nuclear material or any interest therein may be made without regard to the provisions of section 3679 of the Revised Statutes, as amended.

e. Any contract made under this section may be made without regard to section 3709 of the Revised Statutes, as amended, upon certification by the Commission that such action is necessary in the interest of the common defense and security, or upon a showing by the Commission that advertising is not reasonably practicable.

f. Partial and advance payments or deliveries may be made under contracts authorized under this section.

SEC. 56. PRICE.—In determining the price to be paid by the Commission pursuant to section 52 for the production of any special nuclear material, the Commission shall take into consideration the value of the special nuclear material for its intended use by the United States. The price, as may be determined by the Commission, shall apply to all licensed producers of the same material: *Provided, however*, That the Commission may establish guaranteed prices for all special nuclear material delivered to the Commission for such period of time as it may deem necessary but not to exceed ten years; *And provided further*, That no price or guaranteed price hereafter established for plutonium metal or uranium 233 nitrate intended at the time the price or guaranteed price is established for unrestricted use by the United States shall exceed the Commission's charge in effect at the time the price or guaranteed price is established for the same quantity of uranium 235 in uranium (as hexafluoride) containing 20 per centum uranium 235; *And provided further*, That no price or guaranteed price hereafter established for plutonium or uranium 233 intended at the time the price or guaranteed price is established for use as fuel in a nuclear reactor or in research and development or peaceful applications of those materials shall exceed the value, as determined by the Commission at the time the price is established, of the material as fuel in a nuclear reactor, except that no price or guaranteed price for plutonium metal shall exceed 75 per centum of the Commission's established charge in effect at the time such price or guaranteed price is established for the same quantity of U–235 in uranium (as hexafluoride) containing 20 per centum U–235.; and except further, that no price or guaranteed price for U–233 as nitrate shall exceed 93 per centum of the Commission's established charge in effect at the time such price or guaranteed price is established for the same quantity of U–235 in uranium (as hexafluoride) containing 20 per centum U–235.

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
July 9, 1958.

Adm. PAUL F. FOSTER,
Acting General Manager, United States Atomic Energy Commission,
Washington, D. C.

DEAR ADMIRAL FOSTER: This will confirm discussions with Mr. Fields and Commissioner Vance concerning Mr. Cook's letter of June 3, 1958, which enclosed draft legislation reflecting our discussions on the matter of plutonium purchase prices and long-term contract authority.

I believe the draft legislation which Mr. Cook submitted on June 3 does represent the basis of our discussions which would put a maximum price of $16 per gram for plutonium for unrestricted use. It was our intent that this authority should extend only 10 years from the present date, namely up through fiscal year 1968.

In accordance with discussions between Mr. Vance and Mr. Durham, and Mr. Fields and myself, it was agreed that it may be desirable for the committee to act upon the proposed plutonium buy-back arrangements during the current session of Congress, except possibly in connection with the Euratom arrangements which provide for the fuel value. This was on the understanding that the Commission would not proceed to extend the current $30 buy-back price beyond the present period of July 1, 1963, until consideration of further legislative changes along the above lines in the next Congress.

It is of course possible that the committee may wish to consider the buy-back arrangements for unrestricted use when it reviews the Euratom arrangements, but this appears to be doubtful.

Sincerely yours,

JAMES T. RAMEY, *Executive Director.*

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